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How the Shop Manager Can Use an Appraisal

Some Appraisals Not Worth Their Cost—Values to Be Included—Where an Appraisal Helped—How to Prepare an Appraisal—Periodic Inventories

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Miller, Franklin, Basset & Co.

FOR a long time plant appraisals were used solely to set a selling price when the plant changed hands, or as a means to determine how much insurance to carry. More recently they have been used to calculate invested capital, in preparing Federal tax returns. In no event was an appraisal considered to be anything more than a necessary but lamentable expense. As soon as its figures had been digested, it was, as a rule, put in the most inaccessible and dimly lit part of the safe where by no chance could it intrude itself upon the owner's consciousness and remind him of the thousands of dollars tied up in it. And because of the form many appraisals are in, it is no wonder that no attempt has been made to use them as constructive helps to management.

Typical of most appraisals is the one I recently saw of a plant of moderate size, made some two years ago, which was handed to the engineers representing the prospective purchasers as a guide to the negotiable values of plant and equipment. It was a weighty volume in which were long itemized lists of nipples, elbows and what not, with no clue to their use or location. At the right of each page was a single inconspicuous column of assigned values, which investigation proved to be the replacement costs as of the date of the appraisal. These costs were carefully summarized for each building with no reference whatever to the departments operating therein, and the whole was accompanied by a surveyor's map of the property, locating the buildings and nothing else. What possible use such an appraisal with all the toil and expense involved, could have served, other than to give a lump value of the property, is hard to see.

Determining Values

Much—too much—has been said of late, as to the proper values to be presented in an appraisal—whether sound, reproductive or original. The method of arriving at the values has also been a chosen field for academic discussion; whether or not to include tangible assets, patent rights, financing expenses, etc. All of these are of interest, perhaps, to rate-setting bodies controlling the activities of public utilities corporations. But they have very little real interest for the executives of industrial plants whose principal care is to produce a suitable return on investments, and who, therefore, want to know in common-sense terms how the fixed portion of that investment stands, and how it analyzes for each operating department and each machine.

A properly drawn-up industrial appraisal should present only such values, detailed and summarized and accompanied by clear, correct drawings as will best adapt it to the following uses: (1) As a fixed asset record; (2) to set up burden charges and rates of depreciation; (3) to graphically locate equipment; (4) as a basis for tax returns; (5) to establish insurable values.

If more appraisals could stand the test of fulfilling the first three requirements, it would be possible for plant managers to see how they could use them as a basis for the more economical and profitable operation of the business. It is because so many appraisals fail to meet the proper tests that they end up in dusty oblivion.

How One Manager Used an Appraisal

Here, for instance, is how the production manager of a fairly large shop in the automotive industry used an intelligently compiled appraisal in revising the planning and cost system in his shop. War and post-war business had added so many new models, methods and machines that the old system broke down. Production demands were so insistent that no one had time to sit down and analyze the new models for standardization. The only planning attempted was to keep the machines busy and to get work out regardless of set-ups and short-cuts. In fact, no one was especially familiar with the possibilities of the new tools, which were regarded as intruders, let in for a specific use which no longer existed. Detailed costs had to be abandoned as hopeless, and an arbitrary general cost, based on past performances, was assigned to the old models of the product and estimated costs were guessed at for new and special ones.

In the meantime the control records were approaching chaos, and the accounting department spent most of its time sending out calls for help. It had a record of total expenditures, right enough, but the distribution of them was on the hit-or-miss plan—mostly miss. Tax returns were coming due. Prices were changing rapidly and no one knew exactly what to charge for some newly undertaken models. The statements at the end of the 1919 fiscal year justified the most pessimistic expectations. Obviously, heroic efforts to get down to a sound manufacturing basis must be made.

Before deciding upon an appraisal the management attempted to clear up the fog by itself. Three statistical lists of all equipment were made up; one by the accounting department from its records; one by the engineering department from its records; and one by the shop superintendent from an actual survey. No two agreed, even remotely.

Two weeks of discussion followed, at the end of which it was decided to have an appraisal made by disinterested outsiders who should have a free hand to

A. & B. GEAR WORKS

CLEVELAND PLANT

EXHIBIT A V: SCHEDULE (a) - MACHINE TOOLS.

Shop No.		Ann. Dep. %	Original Installed Cost	Cost Dep. to Jan.1,1920
C-7-TL	1 No. 6A Potter & Johnson semi-automatic, four-spindle turret lathe with countershaft. No tools. Mfrs. No. 11,000. Potter & Johnson Mach. Co., Pawtucket, R. I. 1916	5	2 287 00	1 943 95
	* * * *			
F-14-G	1 No. 1 LeBlond Universal Cutter and Reamer Grinder, with cylindrical, internal and gear cutter attachments and countershafts. Mfrs. No. 10,000.			
	1 Extra Universal attachment for above. No. 666.			
	1 Extra Surface Grinder attachment for above. No. 6710 R. K. LeBlond Mach. Tool Co. Cincinnati, Ohio. 1913	6 2/3	470 00	282 00
	* * * *			
B-8-MM	1 No. 2-C Rockford Horizontal Milling Machine with countershaft. Mfrs. No. 8000.			
	1 Extra Twin Dividing Head for above. No. 4300			
	1 Extra No. 2 Plain Dividing Head for above. No. 5400			
	1 Extra Bevelling Head for above. No. 6600. Rockford Machine Tool Co., Rockford, Ill. 1917	5	1 610 00	1 449 00

FIG. 1. A TYPICAL SCHEDULE SHEET

bring the business back under control. The old guesses based on incomplete records were to be scrapped and a fresh start made. It was hoped that this would establish a sure foundation for costs, for the revision and correction of accounts and incidentally for shop planning. The first step was to take a complete census

A. & B. GEAR WORKS

CLEVELAND PLANT

GENERAL SUMMARY OF CLASSIFIED VALUES

	Original Cost	Cost Dep. to Jan.1,1920	Reproductive Value as of 1920.
Exhibit A I - Land	27 500 00	* 55 000 00	55 000 00
(a) Factory Land	27 500 00	55 000 00	55 000 00
Exhibit A II - Land Improvements	8 700 00	7 100 00	13 820 00
(a) Walks, Drives, etc.	8 700 00	7 100 00	13 820 00
Exhibit A III - Buildings & Their Equip.	185 000 00	149 500 00	375 000 00
(a) Buildings	141 050 00	110 750 00	282 000 00
(b) Plumbing	9 550 00	7 370 00	18 100 00
(c) Steam Heating	8 200 00	6 100 00	16 000 00
* * * *			
Exhibit A IV - GENERAL OFFICES	18 750 00	13 570 00	25 500 00
(a) Office Furniture & Fixtures	9 100 00	6 660 00	12 140 00
(b) Office Machines	9 650 00	6 910 00	13 360 00
Exhibit A V - MANF'G EQUIPMENT	396 940 00	292 875 00	740 880 00
(a) Machinery	227 000 00	167 700 00	450 140 00
(b) Electric Motors	8 980 00	6 600 00	17 650 00
(c) Mechanical Transmission	10 260 00	8 150 00	18 400 00
(d) Furnaces	12 580 00	9 370 00	24 560 00
(e) Boilers, Tanks, etc.	14 600 00	10 800 00	27 570 00
(f) Piping	7 810 00	6 100 00	14 220 00
(g) Scales	1 110 00	930 00	2 000 00
(h) Trucks	1 960 00	1 430 00	3 710 00
* * * *			
Grand Total	636 890 00	518 045 00	1 210 200 00

* Appreciated Value.

FIG. 2. CLASSIFIED SUMMARY OF VALUES

of the plant and the equipment in it. This showed prices, performances, capacities and condition.

The accompanying cuts show the form in which the appraisal was presented. Fig. 1 is a typical schedule sheet; Fig. 2, the classified summary of equipment, and Fig. 3 the classified summary of equipment arranged by production centers. All of the values set forth were based upon a search through all available records, books, invoices, time-sheets, etc., and checked as a whole with the principal ledger accounts. Schedules were detailed as far as good judgment warranted. Each item of equipment was assigned a code number, as for instance, *A*-5-*M*. In this code *A* indicated the department in which the item was located; *M* the class of machine or equipment, and 5 the serial number of that type of machine in the department. The corresponding machine was tagged with its number, and referred to by that number in all records.

As part of the appraisal, the engineers prepared in card form a plant register. This, as its name indicates, is a file in which are registered all items of plant and equipment. A card for a typical machine tool is shown in Fig. 4. There is a card for each tool bearing full statistics and the history of the tool. The cards are kept up-to-date in the accounting department, to which the engineering department reports technical changes or additions as they are made.

Uses of the Plant Register

The uses of the plant register in this flexible form are many. For instance:

1. It furnishes a perpetual inventory of all plant and equipment items.
2. It furnishes full physical data of each item.
3. It furnishes the exact new and current values of each item, and the annual rate chargeable against each.
4. The accounting department uses it to assemble depreciation accounts.
5. In card form, it facilitates following a machine, transferred from one department or plant to another. The cards can be grouped or filed in any desired way for any purpose.

The rental value of the floor space for cost purposes is obtained directly from the form shown in Fig. 3 and is pro-rated among the machines according to floor area occupied. Another item necessary in setting machine rates, namely the annual using-up of the machine, is obtained from its register card, Fig. 4.

The machine layout was used for plotting the routing of component parts of the several models. Taken in conjunction with time studies, tool capacities, etc., a more advantageous machine layout was finally developed.

It will be noted that it is relatively easy to work with a machine plan on which the individual tools are identified by numbers, in conjunction with cards bearing complete data regarding them as it is quite impossible to letter the necessary information on the drawing itself in legible fashion.

Separating the Sheep from the Goats

With correct cost and machine data in hand, the plant executives knew just what they had to work with and it was then possible to install a system of shop planning with the result that it was soon possible to segregate the profitable from the unprofitable models. Later on it was possible to reduce the number of models from forty to twelve. A working appraisal was the starting point for these betterments.

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CLEVELAND PLANT

GENERAL SUMMARY OF VALUES ARRANGED BY MANFG. DEPTS.

	Original Cost	Cost Dep. to Jan. 1, 1920
Exhibit B I - Land	27 500 00	55 000 00
(a) Factory Land	27 500 00	55 000 00
Exhibit B II - Land Improvements	8 700 00	7 100 00
* * * *		
Exhibit B III - Buildings and their equipment prorated among manfg. depts. on a space basis.	185 000 00	149 500 00
1. Receiving & Raw Stock 3300 sq.ft.	14 550 00	11 750 00
2. Machine Dept. 8400 "	37 000 00	29 900 00
3. Automatic Mach. Dept. 4500 "	17 900 00	16 100 00
4. Case Dept. 5000 "	22 015 00	17 800 00
5. Assembling " 3000 "	13 210 00	10 680 00
6. Tool & Experim. " 3300 "	14 550 00	11 750 00
* * * *		
Exhibit B IV - General Offices	18 750 00	13 570 00
* * * *		
Exhibit B V - Manufacturing Equipment	396 940 00	292 875 00
1. Receiving and Raw Stock	5 980 00	4 660 00
2. Machine Dept.	92 415 00	69 504 00
3. Automatic Machine Dept.	75 108 00	56 306 00
4. Case Dept.	66 670 00	49 220 00
5. Assembling "	12 814 00	9 180 00
6. Tool & Experim. "	27 560 00	21 255 00
* * * *		
Grand Total	636 890 00	518 045 00

FIG. 3. CLASSIFIED SUMMARY OF EQUIPMENT ARRANGED BY PRODUCTION CENTERS

The foregoing is characteristic of many such instances and the inevitable conclusion is that, from an operating point of view, periodical inventories of plant and equipment are as important as stock-taking.

There is a large class of miscellaneous equipment representing a high investment, the condition of which at any time is ordinarily only a matter of conjecture. These are jigs, punches, dies, attachments for machines, patterns, templets, flasks, and toolroom equipment. Usually, it seems that foremen, who are asked for lists of such equipment, are always just on the point of making one up, or have one in preparation. But, except when the toolroom foreman is unusually capable, there is seldom a satisfactory record of the existence—still less of the value and condition—of such items. They seem to be regarded as expendible, like ammunition. Yet they seldom amount to less than 20 per cent of the total investment in machine-shop equipment.

If an industrial appraisal served no other purpose than to provide a reliable, priced, descriptive list of these individually smaller items, it would still be of demonstrable value to the plant executive. But properly made, and intelligently used, such an appraisal can be made of much broader use, as a tool which will have a daily value in guiding the policies of the business.

Form 3-42

A & B GEAR WORKS
CLEVELAND PLANT REGISTER

Serial Nº C-5-TL Location *Automatic machine dept.*

Description *2⅛"-4-spindle automatic turret lathe with countershaft & 1 set drill supports, Adjustable stud turner, turners with rest, Finishing slide, Automatic dies*

Estimated life 20 years Annual rate of depreciation 5%

Purchased from *Manning Maxwell & Moore N.Y.C.*

Date *1916* Builders Nº *5767* Residual value

Cost			Depreciation		
Purchase price:	*1813.00*		Accrued to 1920	*283*	*80*
Freight:	*37.00*		1920	*54*	*60*
Installation:	*42.00*		1921		
Total		*1892 00*	1922		
Additions & changes			1923		
			1924		
			1925		
			1926		
			1927		
			1928		
			1929		
			1930		
			1931		
			1932		
			1933		
			1934		
			1935		
			1936		
			1937		
			1938		
			1939		
			1940		

FIG. 4. MACHINE REGISTER CARD

Hardening in Hot Oil

BY A. E. TWIGG

I should like now to have some information as to why hot whale oil hardens steel harder than when cold. Now this statement may take the breath away from some of your readers. I heard it stated by a foreman who always prepared his oil bath for hardening cast steel cutters by getting a small die red hot and plunging it into the oil to warm the oil preparatory to hardening. When another foreman was recommended to try this he ridiculed the suggestion, expressing the futility of it. He instanced the provision of circulating water to keep oil cool in the hardening bath by those who know all about such things. He was asked to try it nevertheless, and I suppose he did as he could not be induced to make any further remarks upon the subject although repeatedly asked to do so.

I may say that some time ago I hardened about 30 cutters 2 in. in diameter by ⅞ in. thick. The quenching tank held about two or three pints of oil and the cutters were quenched singly. The last one quenched made the oil so hot that it boiled over and left the previously hardened cutters bare. I went over them all with a file to test them, thinking I had gone too far, but found that they were "all right."

I can quite understand that the boiling point of whale oil is considerably less than that of linseed or tempering oil, but I should like to know the reason for hot oil hardening better than cold oil. It may be because it is more fluid; at any rate some of your hardening experts probably could enlarge upon this subject.

My father, who had some knowledge of the steel button trade in the early fifties told me that he had heard a hardener remark that the oil hardened better at the end of the day when it had become well warmed up.

Our cutters are now heated by natural draft gas furnaces and quenched in hot or warm water, but I should imagine that on the question of warping, or on tricky work, hot oil would be better. I may add that in my first experience of using linseed oil for tempering springs, during which more heat was wanted and more coal was put on the fire, the oil boiled over until the flames nearly reached the ceiling. The top of the thermometer was blown off, though this was not noticed until later. Why the thermometer broke I did not understand, particularly as the maker subsequently informed me that mercury boiled at 620—but I expect he is wiser now as this happened thirty years ago.

Manufacturing Oil-Well Tools in Texas

Unexpected Development of Quantity Manufacture—Using Batteries of Gear-Cutting Machines and Turret Lathes—Oil-Well Tools and How They Work

BY FRED H. COLVIN
Editor, *American Machinist*

EXCEPT in the older oil fields and in the long-settled parts of the country, we do not look for machine shops with manufacturing equipment and methods. This makes it more of a gratifying surprise to find shops down in Texas where oil-well tools and machinery are being manufactured in modern buildings and with up-to-date equipment.

The City of Houston, Tex., has many surprises, but none appeal to the shopman more than to visit such a plant as that of the Hughes Tool Co., with its saw-toothed roof, modern locker rooms with shower bath and all up-to-date appliances, a lunch room and a self-service grocery and supply store for its employees.

Abandoning the old type of well-boring tools and the older method of the Pennsylvania oil fields, the boring of oil wells in the Texas field is a strictly mechanical proposition in which the oil derrick becomes the headstock for the huge vertical boring machine whose boring tool is sometimes on the end of a bar a full mile below the earth's surface. The average depth, however, may perhaps be placed at 2,500 ft. The headstock or driving head is a story by itself, being entirely independent of the tools used and their manufacture. The beginning of the hole is usually made with a flat fish-tail bit, as in Fig. 1, sometimes as large as 20 in. in diameter but more often not exceeding 16 in. When rock is reached, however, it becomes advisable if not absolutely necessary, to use an entirely different type of tool if efficient drilling is to be done. The necessity for this method has developed several types of boring tools or bits, among them the Hughes bit shown in Fig. 2. The cutting members are serrated hard steel cones, two or three being used according to different conditions. As the bit revolves, these cones roll around over the rock, each tooth striking at a different point, crushing and cutting its way through. The mechanic will immediately compare it to the star wheel type of tool used for truing abrasive wheels. These cones are mounted on substantial studs set in a rigid head or body. As this bit is rotated, it cuts its way through the rock, the cuttings being flushed out by a pressure of water from above, provision being made both for the inlet and outlet of this stream. In addition to the end-cutting tools, reaming tools are mounted up in the body of the bit to insure the hole being full size all the way down.

FIG. 1. FISH TAIL BIT

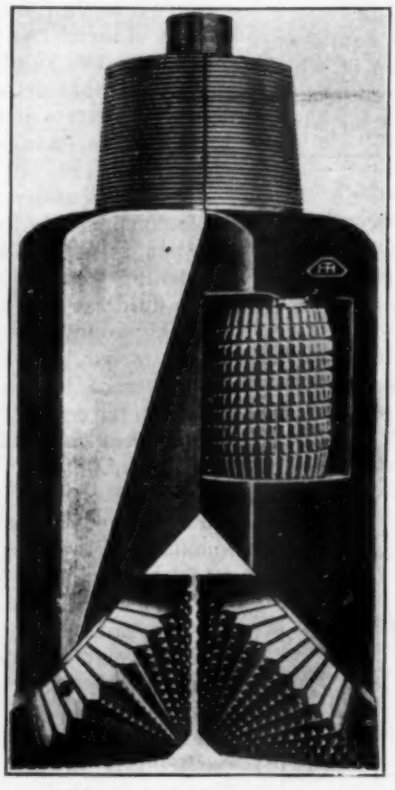


FIG. 2. HUGHES ROLLER BIT

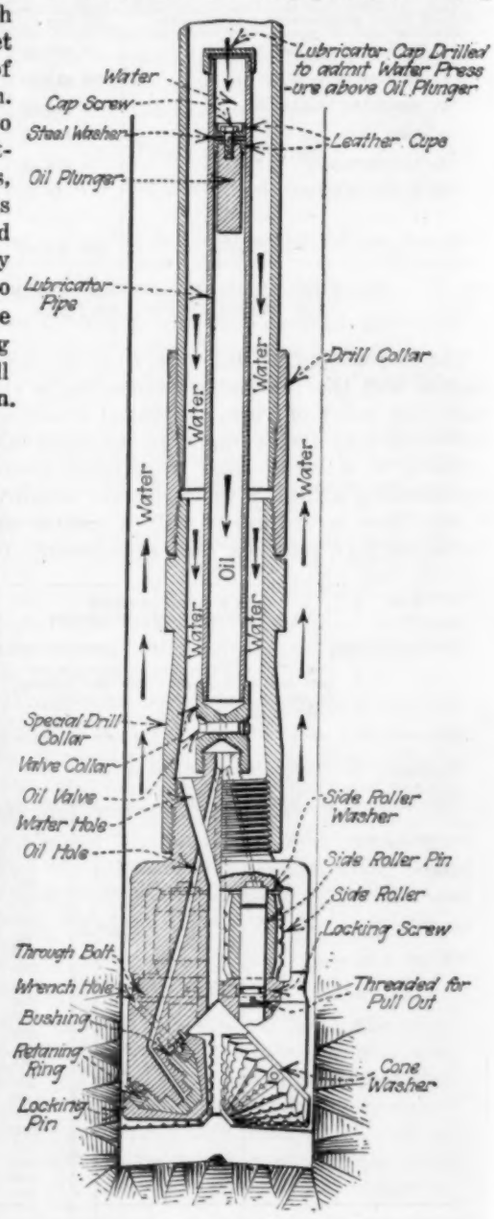


FIG. 3. HUGHES BIT AT WORK

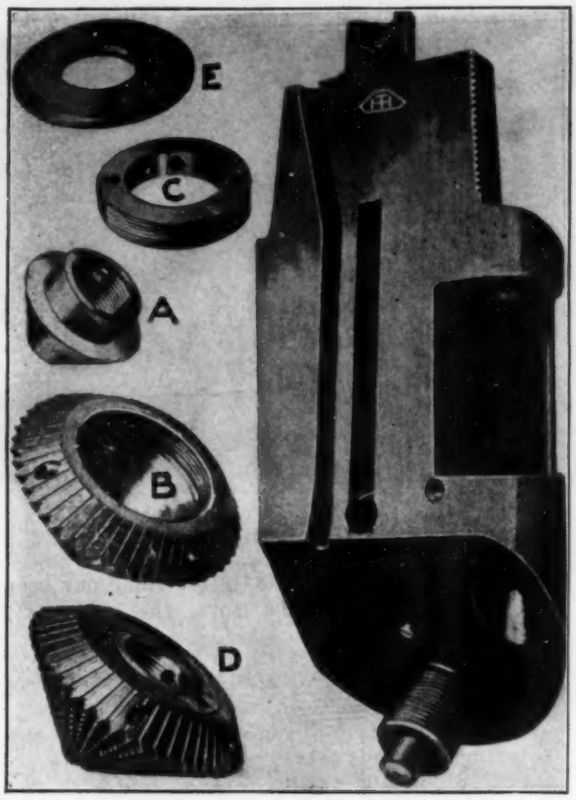


FIG. 4. PARTS OF THE BIT

The way such a bit operates is shown in Fig. 3, in which the various parts of the tool and holder are designated. Water is forced down on the inside of the drill pipe, which varies from 4 to 6 in. in diameter, the excess water as well as the cuttings going up outside of the pipe as indicated. Fig. 4 shows some of the details of construction, among them the conical bronze bushing *A*, which fits inside the cone-cutting tool *B* and the threaded retaining ring *C* holding it in place as shown at *D*. The inside of the bushing screws on a stud on the angular surface of the body of the tool. The other details can be readily understood by comparison with the head as a whole. The odd-shaped, hardened washer *E* forms the end bearing for the collar *C*.

Some idea of the necessity of rigid connection for these boring heads may be had by carefully considering the weight which they carry while drilling. In addition to the weight of the head and of the drilling-tool pipe, which, of course, increases as the well goes down, the tools are also loaded to secure best results. The recommended weight on these bits varies from 2,870 lb. on a bit $2\frac{3}{8}$ in. in diameter to 12,000 lb. on one of $9\frac{1}{4}$ in. diameter. On extremely hard rock, however, it is advised to use less weight and more speed, instead of exceeding the weight given.

The body of the bit is made of steel castings, while the cutting cones and the studs which take the thrust and wear are made of alloy steel and heat treated. Lubrication, necessary to insure satisfactory operation and prevent the various bearings from wearing out, is secured by an oil reservoir seen in the center of Fig. 3, the oil pressure being controlled by the water, and consequently, to some extent at least, by the depth of the hole. Bearing this in mind, the shop views shown in Figs. 5, 6 and 7 will give a good idea of the work done and the equipment which has been installed.

Part of the Gisholt battery is shown in Fig. 5, this, as can be seen, being engaged on a variety of work. The second lathe is making large cones for cutters,

FIG. 5. TURRET LATHE DEPARTMENT IN HUGHES SHOP

FIG. 6. GEAR CUTTING DEPARTMENT

some of them being shown piled on the floor at the end of the lathe. It will also be noted that each lathe is provided with a drip pan at the end for catching the overflow of lubricant. This drip goes back to a main tank where it is settled, and the clean lubricating liquid pumped back to every machine in the shop.

The cones are grooved be-

fore taking from the lathe. After this, they go to the modern double-spindle Gould & Eberhardt gear cutters shown in Fig. 6, where the teeth are automatically cut, some of the finishing cutters being shown on the floor. Next comes the heat treating of the cutters, this department being shown in Fig. 7. There are four good-size hardening furnaces with all the necessary cooling baths, pyrometers and other devices for securing the desired condition of the cutters. The equipment also includes Smalley thread-milling machines for the cones and an up-to-date engine-lathe equipment. Although no women workers show in the illustrations, a goodly number of them are employed and at exactly the same pay as men for the same work. Furthermore, the company ha:

FIG. 7. HEAT-TREATING ROOM

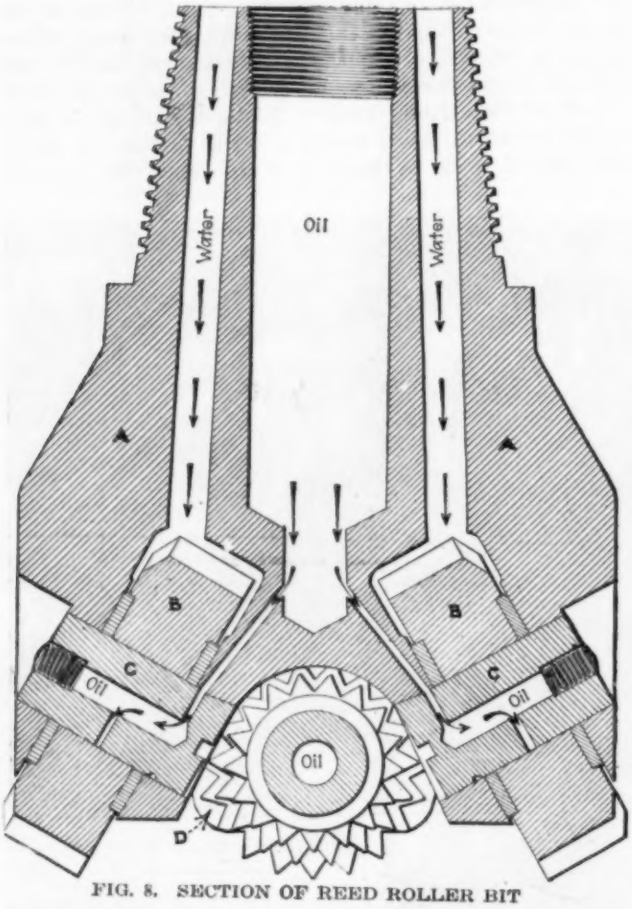


FIG. 8. SECTION OF REED ROLLER BIT

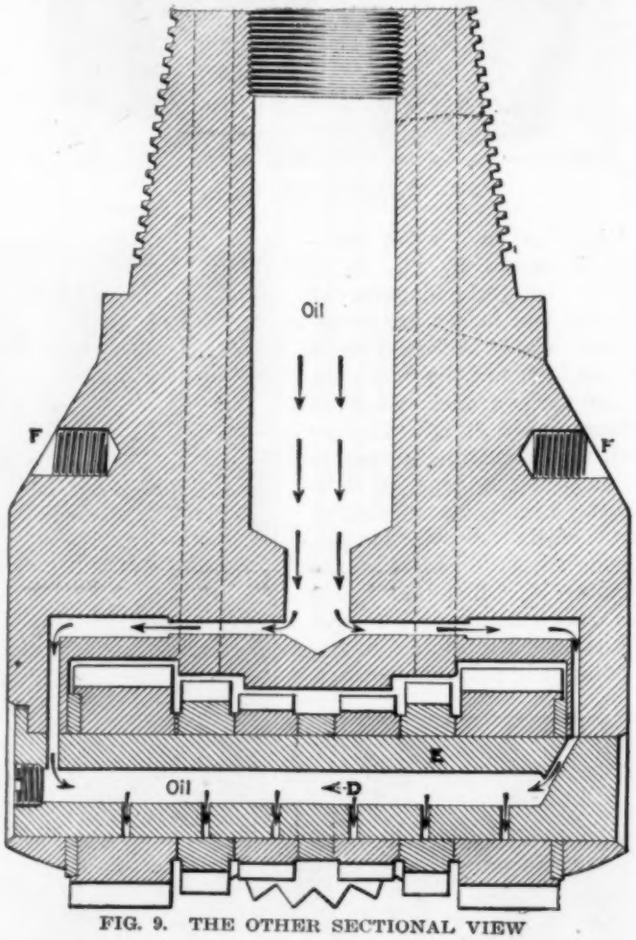


FIG. 9. THE OTHER SECTIONAL VIEW

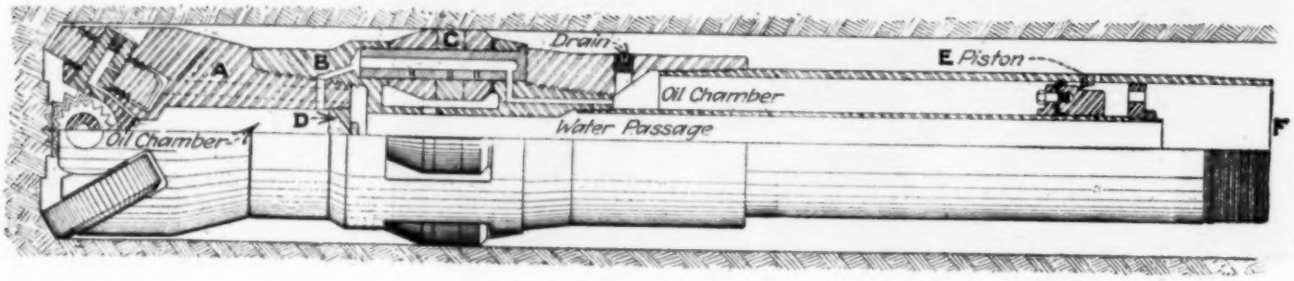


FIG. 10. THE REED BIT AT WORK

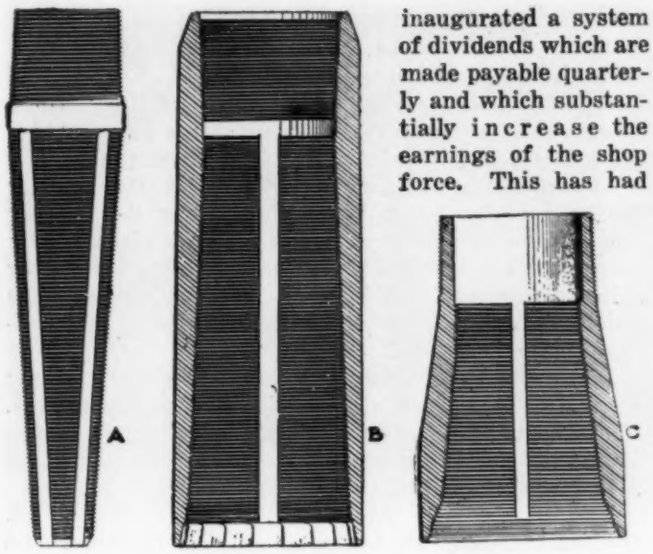


FIG. 11. TOOLS FOR REMOVING PIPE

inaugurated a system of dividends which are made payable quarterly and which substantially increase the earnings of the shop force. This has had the desired effect of stimulating interest in the shop and its production, and is part of a larger plan to make every employee feel that he or she is directly interested in the success and, consequently, in the production of the whole shop.

The Reed Roller Bit Shop

Another interesting shop in Houston and one which is growing at a rapid rate, is that of the Reed Roller Bit Co., makers of the Reed (Caddo type) roller bits. These bits have been developed especially to meet the various conditions that exist in the Texas oil fields but that will be found in other oil fields as well.

Those of us who are not familiar with oil-well boring tools and who consider them as being rough pieces of machinery, do not appreciate the care with which they are designed and constructed. An excellent example of a modern roller bit is shown in Figs. 8 and 9, which give sectional views of the Reed roller bit, known as the "Caddo" type. This bit consists of a substantial one-piece steel head casting *A*. This head has pockets cast in it for the angular cutters *B-B*, the pockets being carefully faced for the hardened steel washers shown on each side. The studs are made with an eccentric head to prevent their turning, so as to insure the oil passages shown being always in position. The studs are held in position by the block *D*, also shown in Fig. 9, the block forming the center bearing for the transverse cutting tools which lie across the face of the bit.

This block essentially prevents any movement on the part of the studs *C-C*, and is itself held in position by the shaft *E*, which also has an eccentric head to hold it in position so as to keep its two oil holes, by which the supply of lubricating oil enters, in their correct position. These two views serve to show the general construction of the boring bit. Fig. 8 shows the passages for both water and oil, the first to wash the cuttings away and force them back up the pipe, and the second to supply a constant stream of lubricant to all of the working parts. The water passages are purposely restricted in the head so as to give velocity to the stream and wash out all particles of rock, both to clear the hole and to prevent abrasion. The side holes *F*, Fig. 9, are drilled and tapped solely for convenience in handling the bit on the derrick frame.

How This Bit Works

The way in which the bit works, and in which oil and water are supplied to it, is shown in Fig. 10. The rolling bit itself, which has already been explained in detail, is shown at *A*. Screwed on this, by means of a sharp taper Acme thread, is the reamer portion *B*. The reamer body carries four sets of cutters as shown at *C*, which act as reamers and assist in making the hole straight and of full diameter. The way in which the oil is conducted from the oil chamber above, through the shafts which carry the reaming cutters, and from there to the oil chamber in the bit itself, is of interest. The lower oil chamber is closed by the cap *D* so as to prevent the water in the central pipe from entering. Its only outlet is through the long drilled holes shown in dotted lines, and more clearly in Fig. 8.

The main oil chamber carries a piston *E* with a cup-leather packing. Above the packing is a baffle plate *F*, which allows the water pressure to act on the annular piston, and so force the oil through the restricted openings, insuring positive lubrication to every cutter. This annular oil chamber has a very large capacity, so as to insure thorough lubrication of the cutters during the longest run. A special heavy oil is required, as the ordinary lubricating oils are easily squeezed out of the bearings, and do not provide proper lubrication.

Some Special Tools

A few other special tools used are shown in Figs. 11 and 12. The tap at *A*, Fig. 11, is used for fishing for broken pipe, being mounted on the end of a string of pipe, and the point enters in the pipe which has disappeared down the well. If it is possible to enter the end of the pipe, the top is threaded into the broken or damaged pipe, and used in pulling it out of the well. This refers to the pipe used in driving the boring tools, rather than the well casing, unless it happens to be one of the places where one case is put down inside the other.

At *B*, Fig. 11, is a coupling or die which has milling teeth cut in the end, and which is lowered over the pipe it is desired to remove. This is necessary in case the

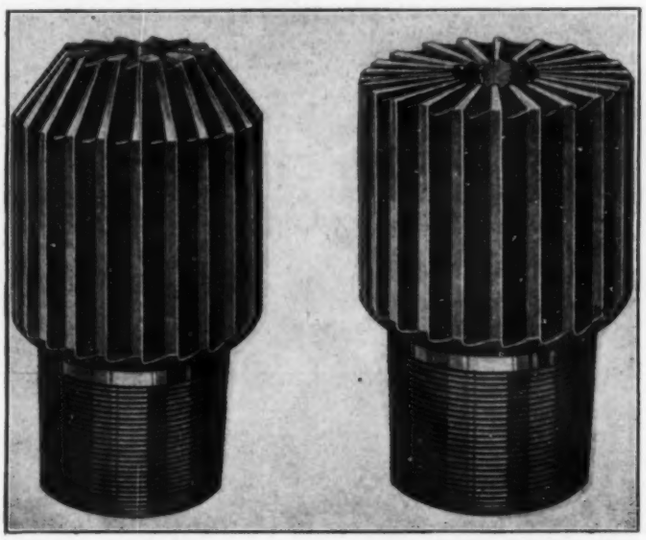


FIG. 12. CUTTERS FOR RECOVERING PIPE

pipe has been crushed so that the tap will not enter. Another form of this tool is shown at *C*, it being used in a socket instead of on the end of a pipe string, as is shown at *B*.

The milling tools shown in Fig. 12 are for cutting

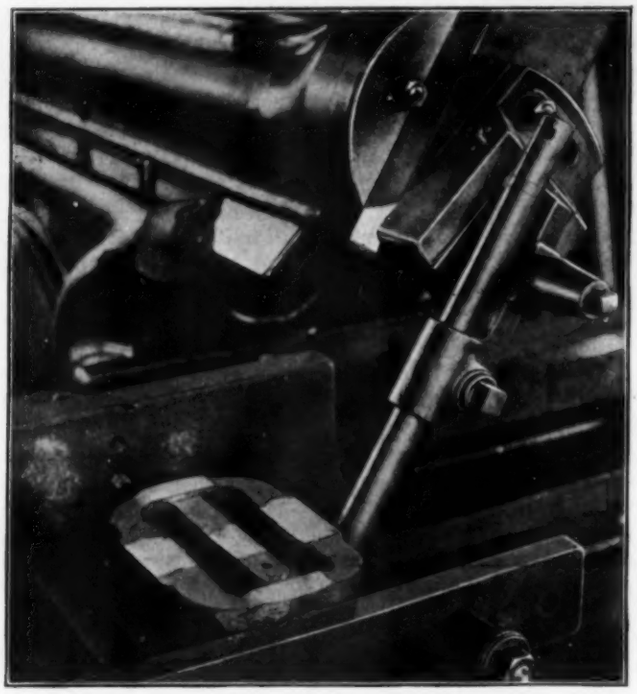


FIG. 13. SHAPING SLOTS FOR CUTTERS

away damaged pipe, it being sometimes necessary to do this before any of the tools shown in Fig. 11 can be used. These tools are practically large milling cutters running up to 12 in. in diameter, and are sometimes necessary for work of this kind.

Coming to the manufacturer of the Reed boring bits, Fig. 13 shows the planing of the pockets for the side or angular rollers. It shows the lower end of the boring head, clamped to a special bracket on the shaper. A boring tool with its holder is used and is so set in the toolhead of the ram as to relieve itself on the return stroke. It will be noted that a central bar or strip is left in the head for laying out purposes, but this is afterward removed to make room for the gang of boring cutters, which fit into the long central pocket.

The special fixture shown in Fig. 14 is clamped over the head of the bit and used for boring the angular hole for the side-cutter studs. The whole piece is then turned so as to bore the corresponding hole on the other side by means of the bushing *A*. The same fixture guides the drill for the long end shaft, one of the bushings being shown at *B*.

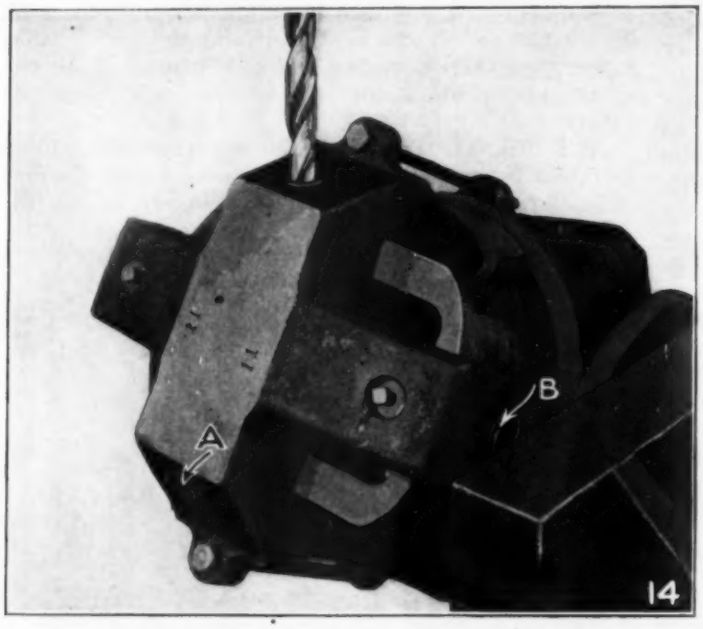
Fig. 15 shows the counterboring of the hole, for the eccentric head on the shaft which carries the cutters. The counterboring cutter, has a pilot which is guided by the plate *A*, being held in position by the screw jack *B* and located by the two pins shown at *C*.

Part of the lathe department is shown in Fig. 16, the lathes being all Lodge & Shipley machines and motor driven.

Fig. 17 shows another department with a radial drilling machine and a milling machine in the foreground and includes one of the drilling fixtures at *A*, while at *B* can be seen the same drilling fixture as was shown in Fig. 14. This view also shows some of the cutters at *C*, which resemble spur gears, except for the shape of the teeth.

More drilling is shown in Figs. 18 and 19, while Fig. 20 shows part of the new lathe department. It will be noted that all these lathes are motor driven in the approved style.

Figs. 21 and 22 show one end of the heat-treating room. The cutters and their supporting shafts and studs are made of carefully selected steel and heat-treated to secure the desired hardness and structure.



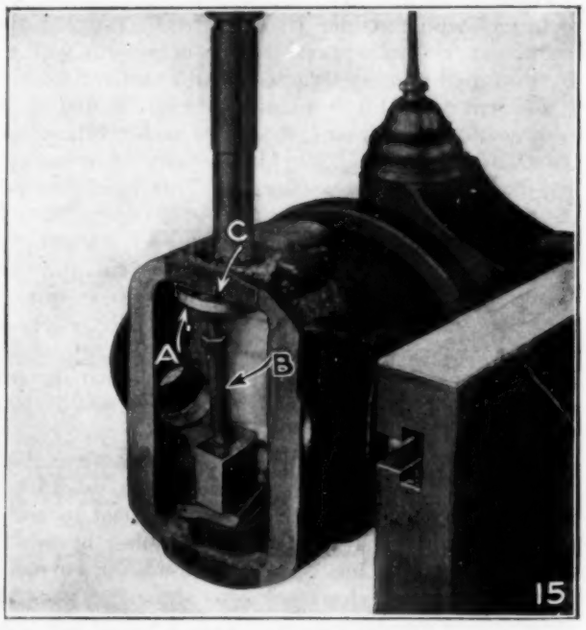


FIG. 14. DRILLING FOR CUTTER SHAFT. FIG. 15. COUNTERBORING FOR ECCENTRIC HEAD

Figs. 19 and 20 show a complete drilling and reaming bit, the former being a side view and the latter an end view, showing the arrangement of the cutters. As can be seen, the bits are of very substantial construction, as is necessary in order for them to force their way through rock of varying hardness.

FIG. 16. ENGINE LATHE DEPARTMENT

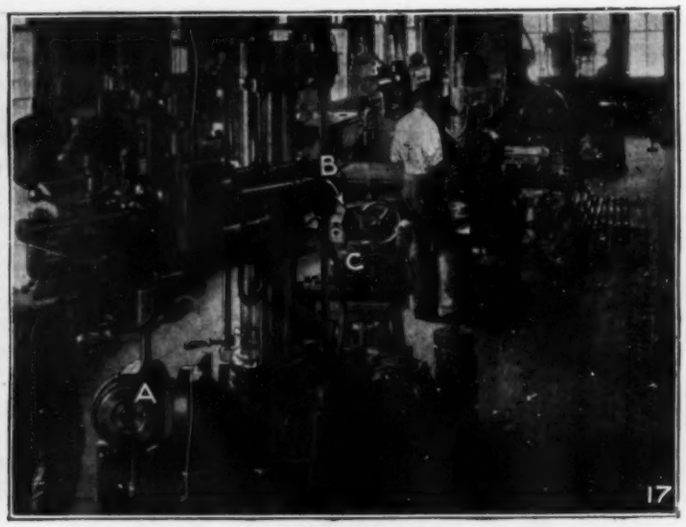
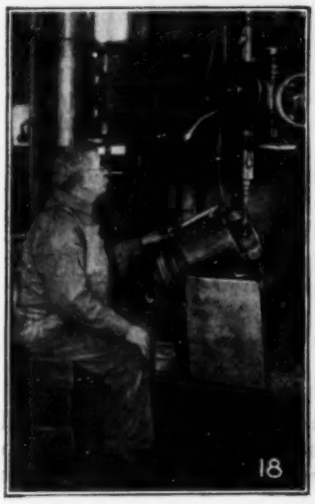


FIG. 17. MILLING AND DRILLING



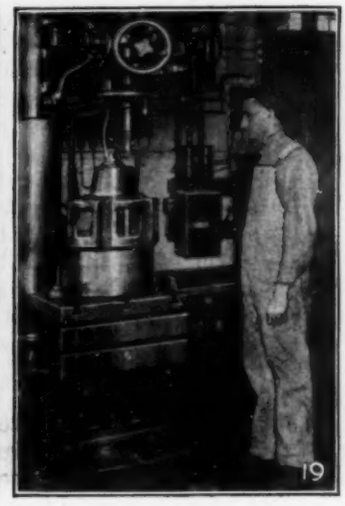
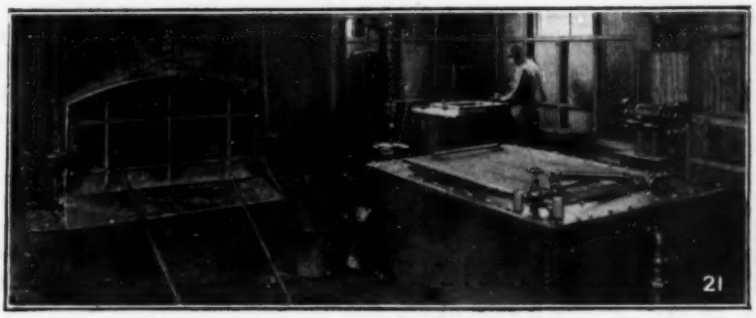


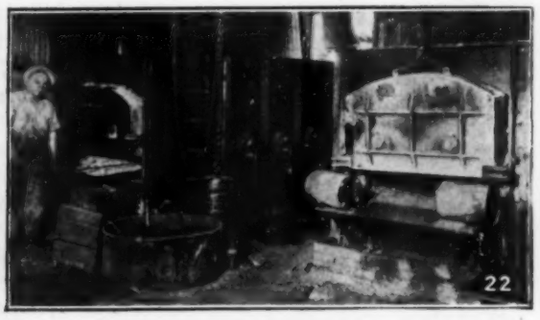
FIG. 18. DRILLING FOR ANGLE CUTTERS. FIG. 19. DRILLING A LARGE HEAD. FIG. 20. MOTOR DRIVEN LATHES

Just to show what sort of work is expected of oil-well drilling tools, the following is copied from a letter sent to the Reed company by a contractor in western Texas:

Started at surface with fish tail bit	13 ft. soil	
Reed rock drill bit	2 ft. flint rock	12 hr.
" "	6 " "	12 hr.
" "	4 " "	15 hr.
" "	14 " lime rock	15 hr.
" "	4 " rock	
" "	17 " yellow clay and rock	12 hr.
" "	22 " hard rock	16 hr.
Reed rock drill bit	24 ft. hard rock	16 hr.
" "	16 " "	24 hr.
" "	3 " "	
Fish tail bit	12 " blue clay	24 hr.
" "	7 " "	
Reed rock drill bit	9 "	12 hr.
Fish tail bit	17 " blue clay	
Reed rock drill bit	3 " rock	18 hr.
Total feet with fish tail bit		49 ft.
Total feet with reed rock bit		124 ft.

This drilling contractor used only one set of cutters to make the above-reported hole, and stated the cutters were not worn out but would be used in the well again. The drill head was not damaged or worn.

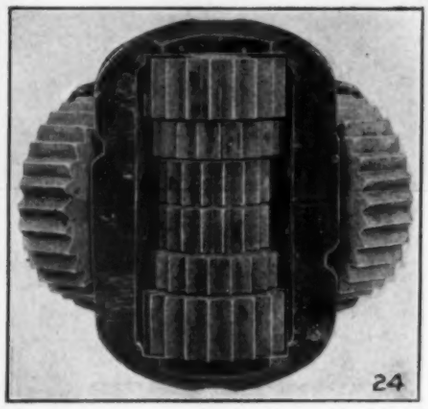




FIGS. 21 AND 22. THE HEAT-TREATING ROOM

In another well in the Goose Creek (Tex.) district, hard rock was encountered at 1,800 ft. below the surface, and 26 ft. was drilled in 3 hours. This work was, of

FIG. 23. SIDE VIEW OF REED BIT
FIG. 24. END VIEW OF REED BIT



course, much less difficult than the flint before referred to. These instances are cited to compare them with the milling-cutter problems of work-tool builders.

Yes! "Design" Jigs and Fixtures

BY C. H. DENGLER

Messrs. Frederick and Grant have hit the nail on the head many times in their remarks on pages 26 and 580 of *American Machinist*, on the subject "Should Jigs and Fixtures be Designed?" As one who has worked under both systems (if the slip-shod way of having the tool designed as it is being constructed can be called a system) I feel it my duty to add a word or two.

I well remember when, quite a few years back, I broke into the "profession." The place was a small automobile company, and before I joined the force the engineering office had handled all the tool designing. In odd minutes tools had been roughly laid out on thick manila paper by one of the busy engineers and shoved along to the shop. These crude drawings were but rough assemblies; the details being left to the patternmaker and toolmaker who were given the job. Many times when the engineer was too busy and a crude drawing was unavailable, the superintendent or toolroom foreman would explain to the toolmaker what was wanted, give him an odd bit of casting and let him puzzle it out himself. The result was generally a puzzle to the machine operator. Rough, crude and cumbersome, its only virtue was that it worked and helped production to some extent.

As a beginner in this place, my first job was to design tools systematically under the watchful eye of the tool superintendent. These were likewise crude drawings—merely assemblies of the work with the tool blocked around it and with figures and other data spread around the sheet. They were better aids, however, to the patternmaker and toolmaker, especially as all tools were actually drawn. This plan worked well when the work was given to a bright toolmaker and production was certainly helped a good bit.

Still these tools were slow and costly to build, as too much thinking was left to the toolmaker; not that he cannot think as well, if not better, than the average draftsman, but that many jig and fixture parts can be standardized and thus much repetition both in the design and the toolroom can be eliminated. A thousand or more parts need standardization in the same way that such work is carried out by the Society of Automotive Engineers for automobile parts; such parts as bushings, jig feet, clamping parts, locking devices, etc., and one, instead of half a dozen, kinds of tapers. This standardization means hours saved not only in designing but in building the tools, for in slack times these parts can be made and stored up for the rush time.

During the late war I was fortunate enough to work in one of the big war plants that encouraged production by all the means available. The shop, the toolroom and the designing rooms were called upon to do their bit. All our tools were "designed" and detailed and checked. And, although it was a very costly and elaborate system, the engines that we produced and the interchangeability established justified it.

Take the Browning gun, for example, with which most people are acquainted; every part is machined to be interchangeable with another, and this is accomplished only by having all parts manufactured under supervision by means of tools designed in the office.

To my mind the proposition boils itself down to how fine shall the work be manufactured and in what quantity, as to whether we shall design the tools or let the shop handle the job with the best means at its disposal. A quantity and quality producing factory will be equipped with a tool design room and capable designers.

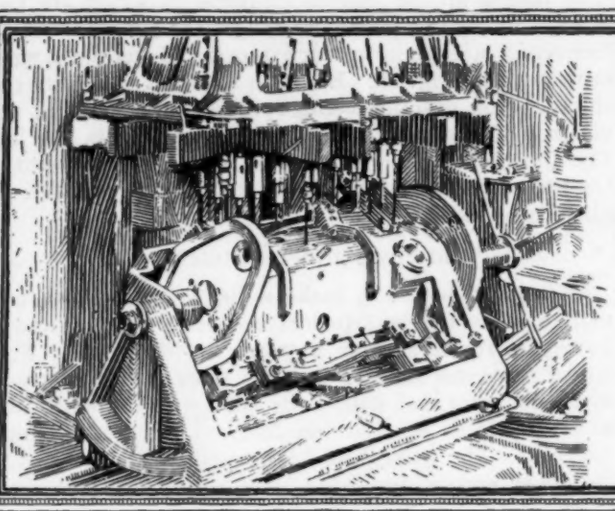
Now while on this subject a word as to the caliber of the designer would not be out of place. Having worked along with hundreds of designers (real and fancied) the best men that I have known have been those with actual shop experience. The shorter the time they had worked in the shop, to a certain degree, the longer they took to plan a tool or machine or operation. Not an awful lot is needed to make a good tool designer; but it is imperative that he should have worked in the shop and on a number of different machines or his work will consist more of inventions than of horse-sense.

One trade is enough for any man to master. Why some will try to combine tool making with tool designing I cannot see. As to having the patternmaker plan the tools as suggested, it is too absurd to even consider seriously. The average patternmaker is at home in his own line, but to ask him to plan a tool to be used on a machine that he knows nothing about, has never run, and probably could not run, is preposterous.

One thing more, while on this toolmaker controversy. Many toolmakers I have known receive the same if not more than many tool designers; so designing cannot offer them any inducements from a pecuniary viewpoint. If manufacturers demand a higher class of tool designers I can see a more livable salary ahead for designers.

Night school drafting is fine, but it would not carry one very far in the average progressive factory designing room unless diligently pursued. They demand a more finished drawing than a tired body and restless brain is capable of producing in the few hours that may be devoted to it at night.

Tool and machine designing seems to be coming to that stage of the game where it is fast taking on the dignities of a worthy profession, and I would not be surprised to see some college incorporate such a course, with a degree at the end of it, in its curriculum.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design Continued—Standard Jigs and Components—Jig Bodies—Standardization of Jig Posts and Thumb Screws—Jig Feet—Locating Plugs—Types of Bushings

THERE are many parts of jigs and fixtures in common use that can be standardized either to obtain uniform design or to enable a factory to make them up in quantities. There are some parts that are seldom used but the general design and proportions of which are so well established that drawings can be made of various sizes to cover practically all conditions. There are also many accessories such as thumbscrews, hand knobs, ejectors, jig bodies and jig leaves, which can be made in certain sizes and carried in stock so that the toolmaker can use them whenever they are shown on a tool drawing without having to make up each one as he requires it. In addition to the parts mentioned it is possible to standardize bushings so that they also can be made up in quantities. However, this is not frequently done as there are so many sizes to take into consideration

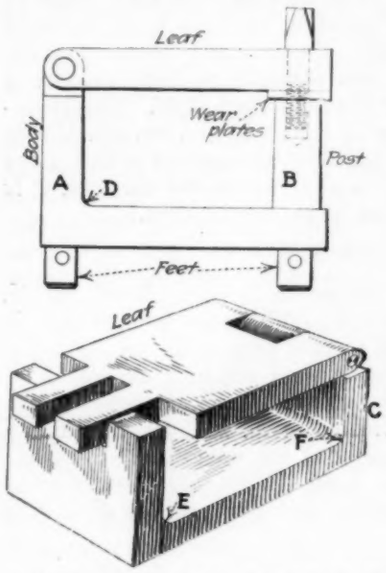


FIG. 55. STANDARD ANGLE AND CHANNEL IRON JIG BODIES

Standard Jig Bodies

There are two varieties of standard jig bodies, the angle-iron form and the channel-iron form; of these varieties the angle-iron form is the more common and is frequently found both in steel and cast iron. The channel-iron jig body is less common except in certain classes of work where a great many parts of small and comparatively uniform sizes are to be jigged. Referring to Fig. 55 a standard steel angle-iron jig body is shown at *A*. The usefulness of such a jig body is very apparent and it has the advantage of being made up cheaply for a variety of usages. For small parts requiring leaf jigs, many combinations can be made with angle irons of this variety. It is easily possible to build up a post like that shown at *B* and fit a leaf with thumbscrew and wear plates, as indicated, to suit a great number of conditions. The jig feet can be screwed into place as shown and can be put in wherever they are needed. Another advantage of this type of jig is that the angle iron can be made in a long strip and planed up accurately and then cut up into sections which may or may not be standardized for width according to the requirements. A great many factories carry angle iron in stock ready for use when needed.

On certain classes of work a channel-iron body may be found a great advantage. For example the channel-iron body *C* may be made up in a number of sizes and may be standardized for width, depth and length. Assuming that three or four sizes are carried in stock it is evident that a leaf may be fitted in; a V-block or locating pin inserted; clamps put on; or other appliances fitted to suit a great number of cases. In the standardization of jig bodies the manufacturer must be governed by the relative size of the components in his product.

It may be well to state in passing that it is advisable to provide good fillets on all angle-iron and channel-iron castings or forgings as shown at *D*, *E* and *F*, to make the sections as strong and serviceable as possible. If it is necessary at any time to fit blocks or other parts around the fillets, it is advisable to chamfer the block rather than to cut out the fillet, so as not to weaken the fixture.

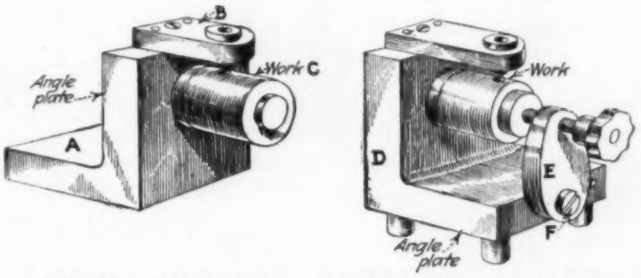


FIG. 56. ANGLE IRON JIGS MADE OF CAST IRON

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The utility of an angle-iron jig is indicated in Fig. 56. The angle irons are of cast iron. There is shown at *A* an angle plate made into a simple jig by applying the bushing plate *B* and a locating stud on which the work *C* is held. This is a very simple form of jig in which the work is held in place by hand while drilling.

Another application of the angle iron jig is shown

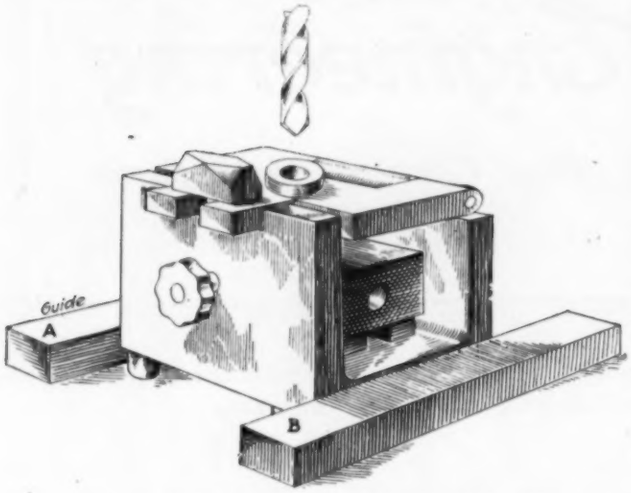


FIG. 57. STANDARD JIG USED BETWEEN GUIDES

at *D*. A bushing of similar form is to be drilled in such quantities that it is advisable to provide a means of clamping the work. The clamp *E* is pivoted at *F* so that it will swing out of the way when not in use, thus allowing the work to be removed from the stud without difficulty. Other applications of angle iron jigs will be mentioned in a subsequent article.

Advantages of Standard Jigs

Another advantage of a standard size and form of jig is in the location of the jig when in use on the drilling machine. Let us assume that a number of different jigs are used from time to time and we know that it takes a little time for the operator to arrange the machine so that each jig will be conveniently handled. By the use of standard jigs it is possible to clamp or screw down guides, as indicated at *A* and *B* in Fig. 57, so that jigs of a standard size can be readily slipped between the guides when changing from one part to another. In the standardization of jigs other applications will be found which will prove profitable in the actual processes of manufacture.

The same idea of using guides can be applied on large cast-iron jigs providing the sides of the jig are finished so they will pass between the guides. In progressive drilling an arrangement of this sort will be found to be a great advantage.

In taking up the various components which are used in built-up jigs we must not forget the jig post and the frequently used quarter-turn screw. Several examples are shown in Fig. 58. Example *A* is not generally considered good practice because there is no locating provision made to take care of abuse or wear in the leaf. The quarter-turn screw *B* does not assist in locating the leaf, and the accuracy is entirely dependent upon the hinge construction.

Jig Posts and Thumbscrews

It is much better to make a jig post as shown at *C* and to allow the leaf to locate on the sides *D* and *E*. Provision for wear may be made as indicated at *F*, in which the same type of jig post is used as that shown at *C*, but provided with wear plates of hardened steel at *G* and *H* so that the accuracy of the leaf fitting is assured. The post can be turned and threaded at its lower end as indicated at *K* and a suitable dowel provided at *L* to make location positive.

A type of jig post sometimes used, shown at *Q*, can readily be made so that it will screw onto the body and it can be furnished with wear plates at *R* and *S* if desired. In addition the leaf can be provided on the sides at *T* and *U* with plates that can be hardened and ground to an accurate fit.

Quarter-turn screws are frequently used in leaf jigs; several varieties are shown in the figure. When screws of this kind are used it is necessary to turn them so that they are in alignment with the slot in the leaf when loading or unloading the jig. A refinement which makes it possible for the operator to turn the screw the right amount every time is shown at *M*. The underside of the thumbscrew is cut away and the pin *N* acts as a stop for the screw. Another method which gives the same result is shown at *O* where the stop pin *P* is fitted to the leaf instead of in the jig post.

Jig Feet

There are several things to be considered in the design of jig feet. They should be made long enough so that there will be room to take care of an accumulation of chips under the jig body, yet not long enough to be fragile. They may be screwed to the jig body, a hole being provided, as indicated at *A*, Fig. 59, in which a pin can be placed to assist in the operation. Occasionally it is desirable to force in the jig feet, instead of screwing them in place, and when this is done it is advisable to use a construction similar to that shown at *B* in which flats are provided to assist in assembling.

A very excellent method of fastening jig feet in place is shown at *C*, a system frequently used when a jig has to be turned or if feet are provided on each side. The nut *D* can be used to draw the foot tightly into position and its location and accuracy can be assured

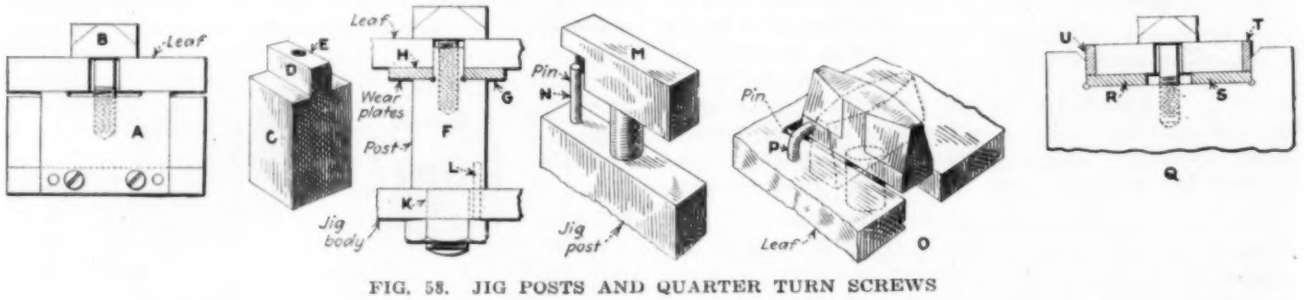


FIG. 58. JIG POSTS AND QUARTER TURN SCREWS

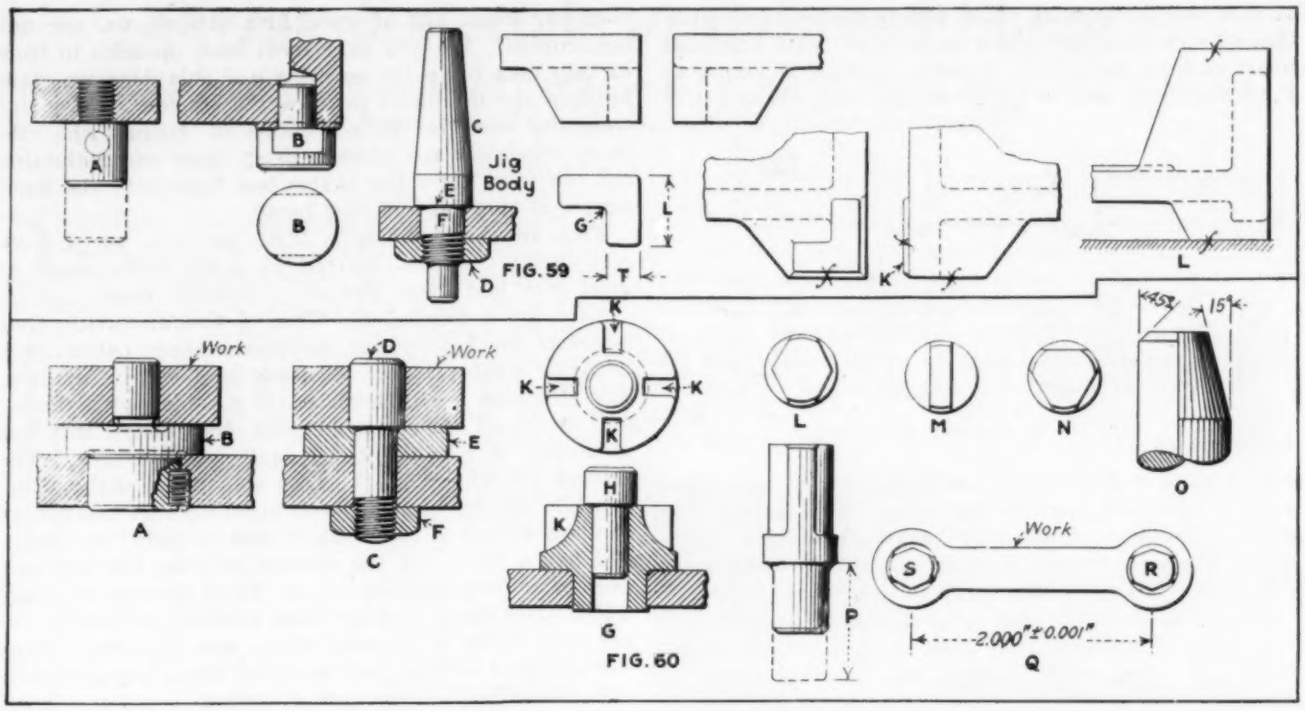


FIG. 59. EXAMPLES OF JIG FEET. FIG. 60. LOCATING PLUGS

by the squareness of the face *E* and the accuracy of the fit on the shank of the foot at *F*. It is advisable to provide means for locking the nut, consequently the thread on the shank should be of fine pitch.

When jig feet are of cast iron it is well to make the thickness *T* of the foot equal to the wall of the jig and the length *L* about two and one-half times the thickness.

It is well to make jig feet for cast-iron jigs in the form of an angle as indicated at *G*. Attention should be paid to the proportions of this angle, if the jig is a small one, in order that it may be large enough to overlap any hole in the drilling machine table. A construction, such as that shown at *H* is recommended when work is to be drilled from two sides of a cast-iron jig; it will be noted that a pad is placed at *K* at right angles to the jig foot, yet on this side of the jig the foot is not built up high because it would make an awkward construction and one that might very easily be broken. When jig feet come opposite each other it is well to make the design similar to that shown at *L*, a construction that is strong and that gives ample clearance for chips.

Locating Plugs

Several designs of locating plugs are shown in Fig. 60. In sketch *A* the plug *B* is made of one piece of steel, a construction requiring considerable labor. It is much better to use a construction similar to that shown at *C* in which the plug *D* is used in connection with a hardened and ground washer *E*. The locating plug is drawn up tightly by means of the nut at *F*.

Care must be taken when a piece of work rests on a flat surface to furnish little space for dirt and chips to accumulate. In sketch *G* a plug is shown at *H* and the work rests on *K*, cut out in four places to give less bearing surface and to provide clearance for the drill after it has run through the work. The slots could be made somewhat larger and thus leave less chance for dirt and chips to accumulate. In making up locating plugs for use in a round hole it is advisable to relieve them so that they will not completely fill the hole. They can be relieved as shown at *L*, *M* or *N*, depending upon circumstances. The methods shown at *L* and *N* are much to be preferred to that shown at *M*. The latter tends to weaken the plug so that it is easily broken. All plugs that are made a drive fit in a jig or fixture must have sufficient stock that they will not loosen easily when in use. The length of drive should be from two and one-half to three times the diameter as shown at *P*.

In chamfering the top of a plug which is to receive a piece of work the angle of the chamfer should be as long as can conveniently be made. It can be from 45 to 15 deg. on the side, but it is much better to approach the 15-deg. angle rather than the 45-deg. angle, as the work will assemble much more easily and will not tend to "cock." A diagram showing a method used in locating a piece of work on two plugs is shown at Q. This is a connecting rod in which the holes at the ends are held within limits of ±0.001 in. The two plugs shown are relieved but not correctly. The plug *R* can remain as it is, but that at *S* should be turned around 90 deg. in order to allow for possible variations in the work.

Types of Bushings

Fig 61 shows a number of types of bushings used in jig construction. Bushing *A*, a common type having no head, is used almost exclusively by some factories, but the majority prefer bushings with heads and we believe this type to be better in the majority of cases on account of the abuse to which bushings are subject. The bushing shown at *B* is undercut at the shoulder. This is not good practice; it is much better to round the bushing slightly as shown at *C* and chamfer the casting a trifle as in this way a bushing is obtained that is stronger and is less likely to crack or break either in use or when hardening.

In the design of slip bushings the knurled form shown

at *D* is frequently used. It is well to state at this point that all slip bushings should be provided with hardened liners as indicated at *E*. A screw bushing, as shown at *F*, is very bad and should never be used. When it is

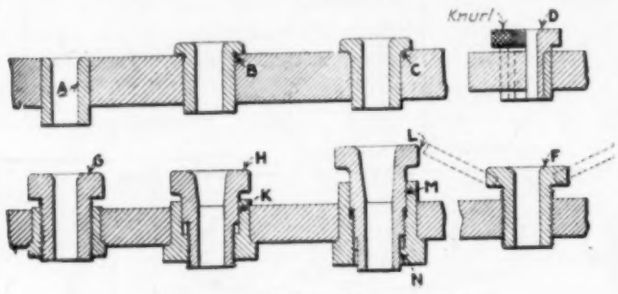


FIG. 61. TYPES OF BUSHINGS

necessary to make bushings so that they will screw into a jig a hardened liner should be provided as indicated at *G*. The head of the liner bushing is on the inside of the jig so that when pressure is exerted on the bushing there will be no tendency to force out the liner.

Screw bushings are used in some cases where a clamping action is needed on the work at the point where the bushing is used. If it is found that no other means of clamping can be used, a much better form of construction is that shown at *H* in Fig. 61. The accuracy of location in the slip-bushing is assured by the cylindrical bearing at *K* and the threaded portion is made a loose fit. An additional refinement is found in bushing *L* which has a cylindrical bearing at *M* and *N* and a thread in the middle. This type insures as high a degree of accuracy as is possible for screw bushings.

Provision should always be made to insert a pin in bushings of this kind in order to facilitate removal. The matter of spring in the jig leaf must also be considered when a screw bushing is used, as it generally is, for clamping. The jig leaf should be re-enforced sufficiently to take care of the strain incurred.

A Loose-Leaf Mechanical Encyclopedia

By P. A. Fredericks

Under the above title on page 385 of the *American Machinist*, C. V. Lovell describes a system of filing cut-outs from mechanical journals. In common with most other mechanics the writer has had a long and bitter experience with trying to file such material to obtain the results listed by Mr. Lovell, and has almost come to the conclusion that "there ain't no such" results possible except at the sacrifice of more time than the average person is able or willing to expend. The most of them work out perfectly well in theory, yet fall down in practice because of the frailty of human nature.

Taking the system described, we are to first read the index and mark our items. Usually halfway down we run across an article we want very much to read *right now* and our system is hung up while we read it. By this time something else has come up and we set the magazine aside to be finished later. Next time we have better luck and finish our index and start marking the articles of interest. In the course of several days and many interruptions we get them marked and lay the magazine to one side to have the holes punched and there it lies indefinitely until the lady of the house informs us that spring housecleaning is about to start and we've got to get rid of those old magazines. We clutch them protectively and start to the basement to bore our holes and if good luck attends us, are not interrupted. We now take them back upstairs in time to help take down the curtains and this done we start hunting for the pliers to draw the staples. The pliers were last seen in the possession of Jimmy who violently disclaims any knowledge of them and maintains that he fixed his roller skates last time with the hand saw, and that he put *that* back.

This an exaggeration? Well, perhaps, but I have seen many systems started in good faith come to grief over just these obstacles or similar ones.

So I am a pessimist. When I find an article that interests me I draw out my trusty paper cutter, jack knife or whatever may be handy and operate at once. The clippings are then placed in a folder with similar articles in an old correspondence file, though this last is merely a refinement and quite unnecessary. The folders are labeled on the tabs and filed alphabetically. A while ago they had to be indexed because there were so many titles and subdivisions that I couldn't remember if I had a folder for the unusual articles, but this concession to complication in my filing system was only added after much throught and crossing of fingers, for my first system and worst failure was all index. Many are the good articles that were lost to me completely by being snatched into the jaw of that all devouring index, and it was a good index at that. I spent most of my waking leisure hours on it and it *had* to be good. I am still of the opinion that it was good, too good for this earth, of human frailty. Anyway it didn't work, and was number one in the list of my failures.

My present system works very well, it isn't perfect, and does not always give me "what I want, when I want it, and where I expected to find it," but taken as a whole, when I have read and filed an article I can go and get it again in most cases, and out with it comes all the other articles of similar nature that I have read for the past ten years, which is a big help as I have an excellent "forgetter."

I sometimes do have to decide if I wish to save an article on bearings from the one side of the leaf or one on wage payment from the other, but I harden my heart and put one or the other of them out of my mind, for the good of my lack of system. Knowing that I cannot possibly file all the available human knowledge and that my files therefore will never be quite complete, I usually find that I don't miss that particular article.

Using Up the Short Pencils

By H. S. Trecartin

There is a great satisfaction in using a new, full-length pencil, especially when drawing or sketching free hand. After the pencil has been used down to half its original length, it cramps the hand, and handicaps execution. Even if one likes the metal devices for holding pencils, with their hard ridges and bulky weight, they are seldom at hand, or are attached to other pencils.

I grew tired of the stubs, and collecting a half dozen of them I made an experiment. I mixed a little flour paste and cut a dozen strips of light wrapping paper about 6 x 3 in. I smeared the paste over one side of a sheet and then rolled it into a cylinder 6 in. long. I put about ¾ in. of the the end of one of the short pencils in the cylinder as I rolled it.

In an hour I found that the cylinders of paper were so stiff that it was impossible to tell where the pencils stopped inside them, and they made a light, solid, close-fitting extension.

Saving Materials in Railroad Shops

Recovering Lining Metal from Worn Car Journal Bearings—Lining and Boring Bearings—Large Amounts of Old Bolts and Air Hose Salvaged

BY FRANK A. STANLEY

ONE of the many important items of saving in the railroad shop is the reclamation of lining metal from old journal brasses, shoes and wedges, etc. And the melting out of the old and worn lining from journal bearings also allows the old brass in many instances to be relined and put into service again, thus effecting an economy besides the simple saving of lining metal. In one railroad shop during a certain month the brasses lined included 3,000 old brasses and 4,500 new ones. In other words, 40 per cent of the total number of bearings were old ones relined. The lining department pours about one ton of babbitt a day, including new and old work. The saving effected by the melting out of old metal is considerable.

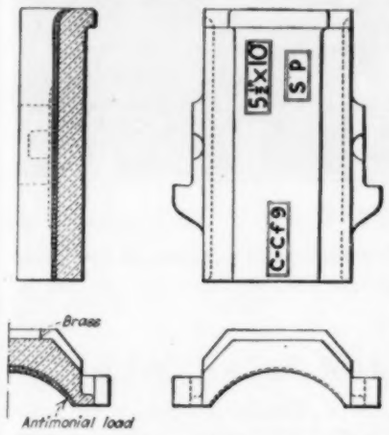


FIG. 1. CAR JOURNAL BEARING

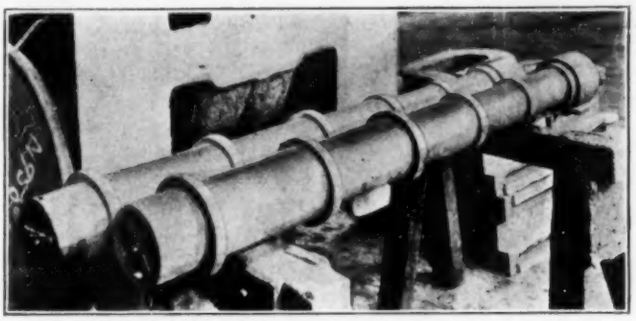


FIG. 2. GAGES FOR TESTING BEARINGS

Fig. 1 shows a standard 5½ x 10-in. journal bearing and Fig. 2 shows a pair of gages used for testing such bearings. The method of mounting such gages is illustrated in Fig. 3.

The gage is an iron casting and the ends are turned down to form necks which are fitted in cradles at the top of the brackets that form the supports for the device. Bolts through the gage neck and bracket top hold the cylindrical casting firmly in position.

As shown in Fig. 3, the gage has five sections, each used for a different size of bearing. The range of the gage diameters illustrated is from 4$\frac{3}{4}$ to 6$\frac{3}{4}$ in. All babbitting mandrels for brasses are made $\frac{1}{8}$ in. larger in diameter than the gaging diameters given on the drawing. The gage proper is cast with cross webs at the ends which allow center holes to be drilled and countersunk directly in the casting to permit it being mounted in the lathe.

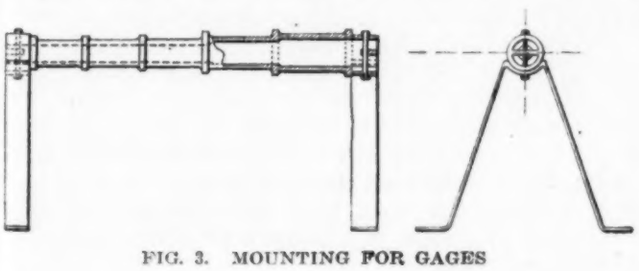


FIG. 3. MOUNTING FOR GAGES

In service the wear on the brasses or bearings comes

FIG. 4. BORING BEARINGS AFTER LINING

both on the lining diameter and on the over-all length. The gages are made to allow for a certain latitude in both diameter and length to determine whether the brass is to be scrapped or relined.

The babbitting arbor has a flanged base upon which it stands upright, two boxes being clamped to opposite sides. The average amount of metal poured in relining brasses is about 3 lb. each.

Some car brasses last for years and with occasional

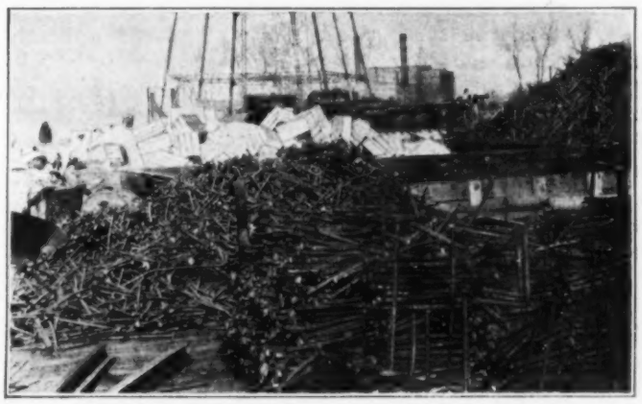


FIG. 5. OLD BOLTS TO BE RECLAIMED

relining have been known to run for as long as ten years before being sent to the scrap heap. All new brasses, after pouring, are bored to size. Old brasses are not bored but are relined by pouring on an arbor closely to size.

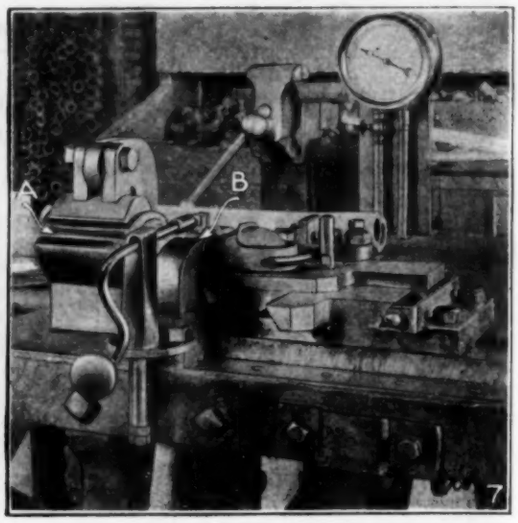


FIG. 6. USED AIR HOSE IN STORAGE. FIG. 7. PUTTING COUPLINGS ON AIR HOSE

A double-end boring machine is used for this work, one end being illustrated in Fig. 4. The spindles are driven by gearing at the center of the machine and the outer ends of the boring bars are supported in the housing seen at the right. Two brasses are carried in a fixture forming part of the carriage on the machine ways and the two brasses are secured by a clamp bar operated by the handwheel at the top. The boring bars carry flat cutters for boring and for facing the ends. The old lining melted out of brasses is analyzed for content and new metal added to bring the mixture up to the required specifications.

Salvage From the Scrap Yards

The manner in which old bolts of all kinds accumulate in the scrap yards is indicated in Fig. 5. Such bolts are sorted out, taken to the reclamation shops, cut off, straightened, re-threaded and put into condition for service. Similarly nuts of all kinds are salvaged by sorting and retapping. The extent of salvage is indicated by such figures as cover the retapping of nuts, say, for a single month which have totaled up to 75,000.

Reclaiming Airhose

Air hose, like other parts, is reclaimed in great quantities, and Fig. 6 illustrates a storage space for this material at the scrap docks. Fig. 7 shows a bench machine for mounting air-hose connections.

This apparatus receives the hose with the clamp on the end. The length of hose is placed in the bench fixture and the coupling or connection placed on a sliding member located at the right-hand end of the outfit. The hose length is gripped between two jaws at *A* (shown closed) operated by a lever at the rear which is actuated by means of an air piston under the bench. When air is admitted to the cylinder the hose is gripped and at the same time the slide at the right is operated to force the connection tight into the end of the hose. The operation is very rapid and as quickly as it is performed it is followed up by a closing action of the pair of narrow jaws *B* at the extreme right-hand end of the hose. These jaws close upon the clamp and enable it to be easily tightened in place by means of the crank-operated wrench shown projecting from the front. This wrench is like a bit stock in form and is always carried in convenient manner by a swivel bracket through which it passes freely.

The methods described and tools illustrated are from the shops of the Southern Pacific Company at Sacramento, Cal.

Some Standards of the Last Century

By F. P. Terry
Belfast, Ireland

I have read with interest the contribution of L. L. Thwing, under the above heading, on page 224 of the *American Machinist*, and think that the writer has not grasped the real state of affairs existing at that time; and it is somewhat difficult to use them as a comparison or contrast with the present state of affairs.

Referring to Mr. Thwing's remarks on the cost of planing as recorded by Mr. Clements it must be remembered that this machine was worked by man power and was one of the first, if not the first planer constructed.

The troubles of James Watt, inadvertently given as happening in 1879 instead of 1779, were not the cost of machinery but lack of good mechanics and tools.

Mr. Thwing's views on the wages paid at that time are also seriously at fault when he records that "after working several years for Bramah, Maudslay's pay was increased to only 7½d per week (nominally 15 cents), probably with board." The actual facts were that Bramah sent for Maudslay to obtain advice on the production of his locks, and was so impressed by Maudslay's sensible reasoning that he made him a handsome present and an offer of employment, which Maudslay accepted, and, soon after, we find him walking to Woolwich every Saturday night to hand over part of his wages to his mother.

After a few years Maudslay became head foreman and found 30s per week not enough; so he decided to start in business on his own account. This sum was about double the ordinary mechanic's wage at that time, and it may be safely assumed that Maudslay's initial salary was 15s without board or any other emoluments.

No doubt then, as now, wages varied considerably, as soon after, we find that Bramah engaged Joseph Clements as chief draftsman for five years with a salary of £3 per week to start with, rising by annual increases of 4s per week; while by way of contrast Edward Harland (afterward Sir Edward Harland, and founder of the firm of Harland & Wolff Ltd.) admitted that in 1852, when chief draftsman in a Glasgow shipyard, his wages were £1 per week.

Magnetic Chucks

Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

VIII.—Persons-Arter Chuck

The Persons-Arter a Single Magnet Chuck—Simple Construction — But One Coil Used—Experiments with Various Forms of Chuck—Filings Test to Show Presence of Magnetism

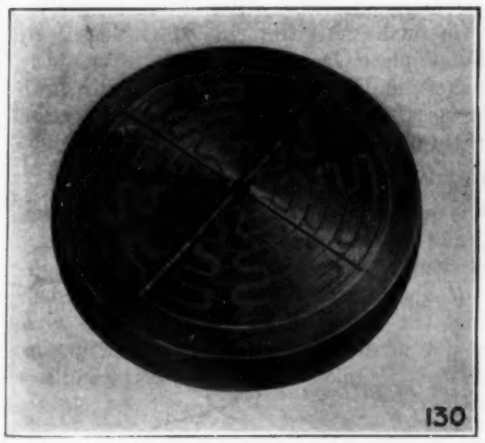
THE latest entry thus far into the field of manufacture of the magnetic chuck is the Persons-Arter Machine Co., of Worcester, Mass., maker of grinding machinery. Mr. Arter, the engineer-member of the firm, being an expert electrical engineer, incorporated in the design of his machine the special holding device now known as the Persons-Arter Magnetic Chuck, the feature of which is simplicity of construction. Characteristically it is the single-magnet chuck and does not differ in principle from others of that designation.

At the time when the Persons-Arter rotary surface grinding machine was designed, the magnetic chuck had already given ample demonstration not only of its capability but almost of its indispensability as a work table for such machines; therefore, the designer was not so much concerned with the possible ultimate holding strength of the device, as with the distribution of that strength evenly and in small areas over the entire surface, so that it would hold firmly a full load of comparatively small pieces.

Even Distribution of Holding Power Difficult

To thus distribute the holding power over a surface that is bounded by a circle and in a manner that provides small magnetic areas without corresponding areas that are disproportionately large, necessitated a somewhat intricate pattern that would ordinarily involve comparatively high production costs. Mr. Arter's objective was then to so co-ordinate these opposing factors as to combine, as far as possible, even distribution with simplicity of construction.

A standard rotary magnetic chuck of the Persons-Arter design may be seen in Fig. 130. The concentric



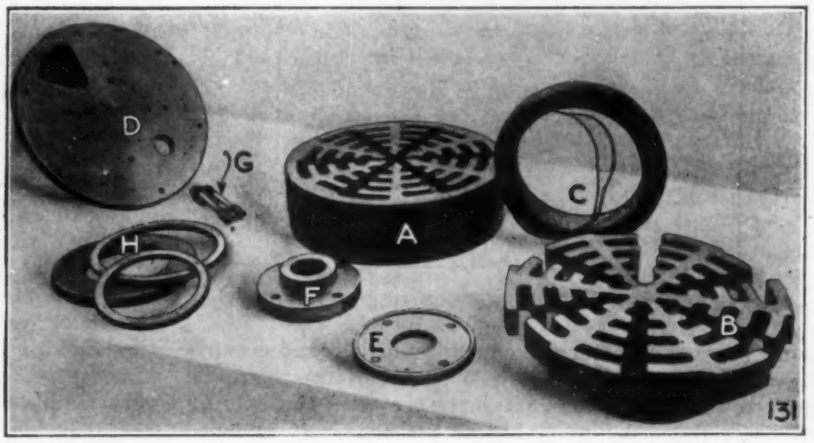


FIG. 130. THE FINISHED CHUCK. FIG. 131. THE PARTS

circles and the four radial divisions do not represent actual division in the chuck, but are shallow grooves cut with a tool after the chuck is otherwise completed. Their purpose is to assist in keeping the work-holding surface clean and clear of particles of grit or abrasive material by providing channels into which such particles may fall and be washed out by the solution with which the work is usually flooded. The concentric grooves also aid in locating work centrally on the chuck, and the radial grooves provide a convenient place for the insertion of a pointed tool with which to lift off heavy pieces or to start a thin piece that may be held, to some extent, by suction.

The central hole to be seen in this cut serves two purposes: It provides for the chucking of circular pieces having a projecting hub; and it furnishes a setting for a plug upon which to center work that must be ground concentrically. It is bored in solid metal, as a reference to Fig. 131 will show, and does not penetrate to the interior of the chuck.

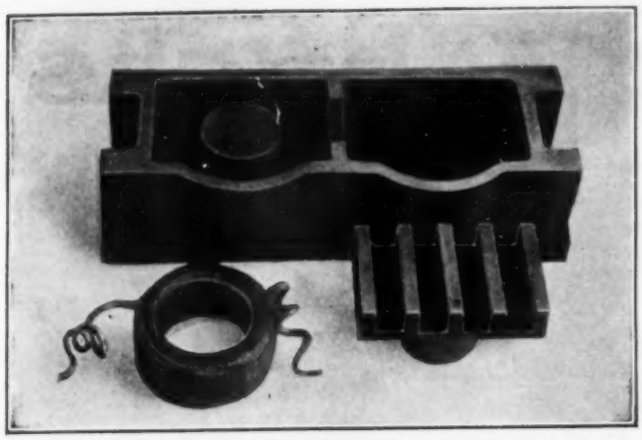


FIG. 132. SOME PARTS OF THE RECTANGULAR CHUCK

The area beyond the magnetic surface is an annular ring of cast iron, hollow underneath and slightly flaring on its circumference. It is not essential to the working of the chuck nor permanently a part of it,

FIG. 133. SHELL AND POLEPIECE BEFORE FITTING

being pressed on after the chuck is finished and occupying a position slightly below the level of the magnetic surface, so that it does not interfere with the holding of pieces that may project over the edge. It is called the water-guard, or sometimes the "skirt," and its

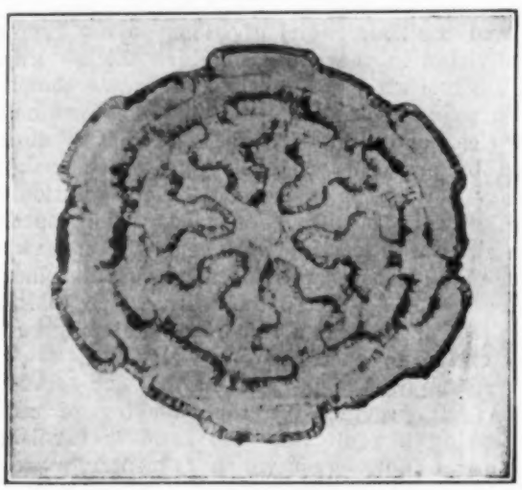


FIG. 134. PERSONS-ARTER CHUCK UNDER THE FILINGS TEST

purpose is to protect the spindle bearings of the machine from particles of abrasive, by throwing the water outside a permanent guard ring which is cast integral with the hood or basin that, in the Persons-Arter grinding machine, surrounds the chuck and work. If the chuck is to be used on other machines a differently shaped water-guard would be needed; or if adapted to horizontal spindle and used without water, the guard would be taken off.

Claims Cover Rectangular Form

Though the claims of the Arter patent cover rectangular chucks as well as rotary ones, it is with the latter form that the designer is principally concerned. Simplicity of construction being an important desideratum, the number of parts used to make up the chuck has been kept as low as possible. There are but three pieces of metal used to make up the magnetic circuit and these, together with the other parts, are shown in Fig. 131.

The body of the chuck is a cylindrical shell of cast steel, shown at *A*, one end being entirely open and the other partly closed by a web about 1¼ in. thick, in which is the irregularly shaped opening to match the opposing polepiece. This polepiece *B* is also a steel casting and has its branches cast integral with a solid hub, the diameter of which corresponds to the internal diameter of the coil *C*. When the polepiece is set in its proper position and the non-magnetic material is poured, thus binding the two parts into one while at the same time permanently separating them magnetically, the hub *B* is flush with the rim of the shell *A*, and the round flat plate *D*, closing and sealing the open end of the shell, makes magnetic contact with both of them and forms the necessary "back-bar" through which the magnetic flux passes.

Cover Makes Water-Tight Joint with Body

The cover *D* is a steel casting having no projection on either side, and is, therefore, a very simple piece to finish by grinding. Attached to both hub of polepiece and rim of shell by screws, it effectually seals the chuck against the intrusion of water, at the same time making the job of disassembling the chuck, in case it becomes necessary to take out or repair the coils, a very simple one.

Only Circular Coils Used

There is but one shape to the coil of a Persons-Arter chuck, though each size of chuck, of course, requires a corresponding size of coil. This is true of the rectangular, as well as of the rotary chuck, the rectangular chuck being designed purposely so as to take the round coil and thus avoid multiplicity of parts.

The makers of this chuck do not attempt the coil winding themselves. As the coils are practically identical with those used in certain standard types of electrical machinery, Persons-Arter finds it more satisfactory to purchase them from a firm that makes coil-winding its sole business.

In Fig. 132 may be seen the main parts of a small rectangular chuck showing how it is adapted to the round coil. This chuck is shown inverted and without the bottom plate. One of the polepieces is set in place and the other is left outside (and in reversed position) to show its shape. Chucks can be made to any desired length by increasing the number of compartments in the shell and using a corresponding number of coils and core-pieces.

In mounting a rotary chuck upon the machine for which it is intended, the designer interposes a magnetic insulator in the shape of the bronze disk *E*, Fig. 131, between the bottom plate *D* of the chuck and the cast-iron driving plate *F*, by which the chuck is secured to the spindle of the machine. The driving plate is attached to the bottom plate *D* of the chuck by bronze screws passing through the separating disk. In similar manner the rectangular chuck is provided with four, six or more "feet" of bronze, which prevent the chuck itself from coming in magnetic contact with the machine upon which it is used.

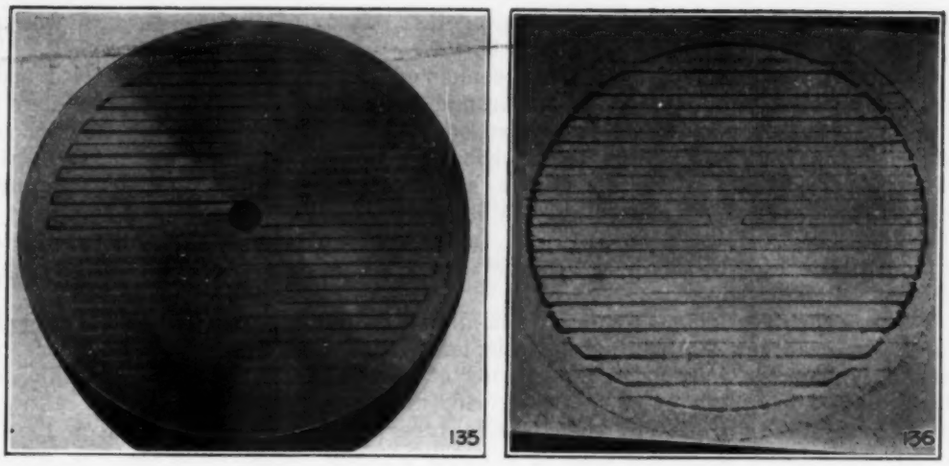


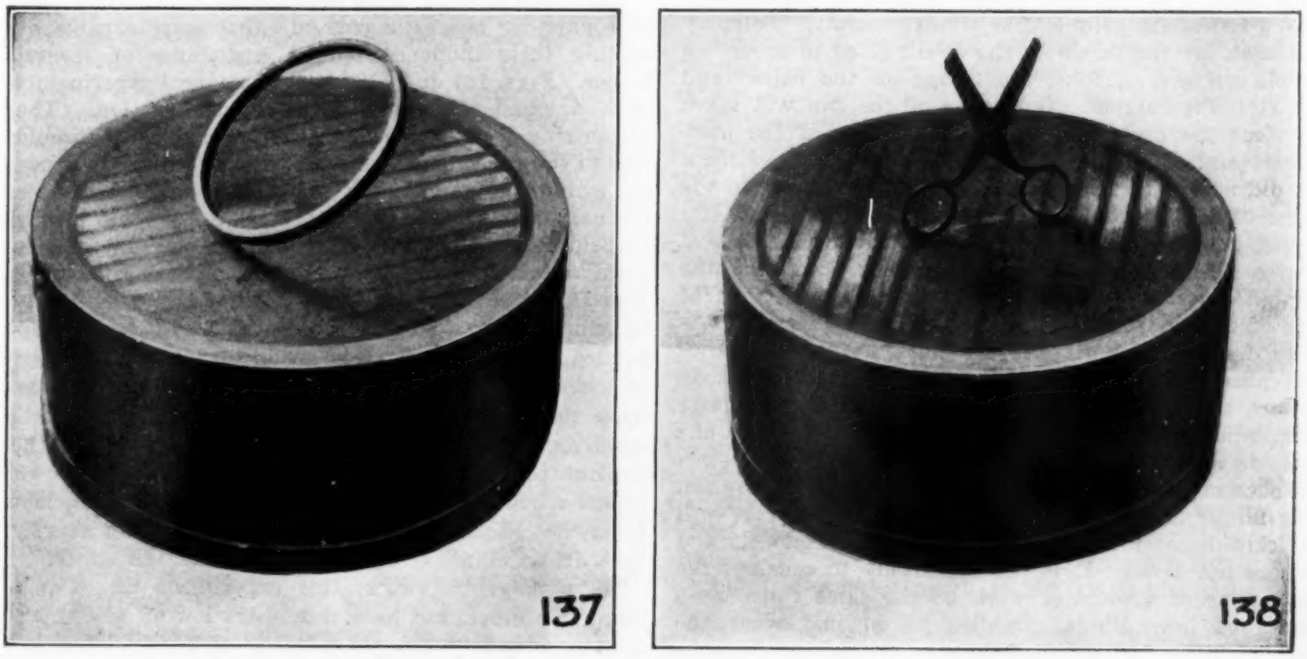
FIG. 135. THE FACE OF THE CHUCK. FIG. 136. AS IT APPEARED UNDER THE FILINGS TEST

In all probability there is no more reason why stray lines of force should escape from the body of a properly designed single-magnet chuck and find their way back through machine, spindle and cutting tool to the opposed pole on the work-holding surface, than that they should follow the same path when other forms of chucks are used. In either case an ample and direct path is provided within the chuck itself. However, the designer of this one is taking no chances.

Electric current is conducted to the coil of a rotary chuck through two fingers of spring brass, shown at *G* in Fig. 131, upon the ends of which are mounted pieces of carbon that make contact with the bronze collector rings *H*. These rings are attached to, but insulated from, the bottom plate *D* by a bakelite ring, also shown at *H*. Electrical connection between these collector rings and the coil is established by soldering the lead wires of the coil to the rings. The wires pass through micarta-bushed holes in the triangular shaped depression to be seen in the bottom plate.

As the construction of the Persons-Arter chuck is so very simple it naturally follows that there are no unusual methods employed in its manufacture. The first operation upon the castings is the facing on both shell and polepiece of the surface that is to become the holding surface of the chuck, for this chuck uses no extra top plate or other auxiliary device, except in special cases where the work is not flat. The facing is done either in lathe or grinding machine, according to which may be most convenient at the moment, there being little if any difference between the two means in point of production cost.

The second operation is the fitting of the polepieces to the opening in the shell. No tools are needed but a bench vise and file. If sand-molded castings could always be depended upon to come true to pattern, this operation would be superfluous, but there are always slight irregularities and lumps in the castings that must be removed in order to make certain that parts of opposed polarity do not come too close together and thus cause excessive leakage of magnetic flux with its consequent loss of holding power. In Fig. 133 may



FIGS. 137 AND 138. EXPERIMENTS WITH A SIMILAR CHUCK

be seen a shell and a polepiece set together, face upward.

After this fitting is satisfactorily completed, and there is an even and unbroken space around the contour, the parts are placed face downward on a surface plate, arranged in their respective positions, and the metal divider, which is in this case a hard babbitt, is poured. From this point onward it is handled as one piece, being turned, bored, faced, and the hub turned to size exactly as would be done with a single piece of similar shape.

When the metal divider is poured it is allowed to fill above the branches of the core, or polepiece, so that upon looking down into the inverted body of a chuck the bottom appears to be a sheet of lead, unbroken except for the central hub. The entire inner surface is machined true for the sake of securing a condition of running balance.

Precautions Against Admitting or Retaining Moisture Within the Chuck

The designer of the Persons-Arter chuck believes that sweating, due to the vaporization of moisture contained within the shell, is the cause of the trouble sometimes experienced by users of magnetic chucks from the breaking down of the coil, and therefore takes elaborate precautions to minimize it. Not only are the top plates made as nearly water-proof as possible, but channels are provided within the chuck body that will tend to eject, by centrifugal force, any water that may find its way in and a series of inclined vents in the shell keep a current of air circulating within it.

The Filings Test to Show Presence of Magnetism

Leading up to the present distinctive pattern, by which his chuck may be recognized at a glance, Mr. Arter conducted some interesting experiments to demonstrate the relative value of variously shaped polepieces as distributors of magnetism. This problem is not as difficult as it might seem at first. All the paraphernalia needed, besides the experimental chuck, is a handful of dry iron filings, a sheet of white paper and a fan of the palm-leaf or similar variety. To apply the test, lay the paper on the chuck so as to cover the whole surface, sprinkle the filings on the paper, and turn on the current. One wave of the fan will serve to clear the central area of each section of the polepieces and drive the particles of metal (such of them as did not go there when the current came on) to the edge of the poles.

An illustration of the test applied to a standard Persons-Arter chuck is shown in Fig. 134. To the casual observer it would appear that the only part of the magnetic surface that is really magnetic is the lead division lines between the poles. This appearance is caused by the attraction of the iron particles to where the flow of the magnetic current is strongest; viz., where it passes across the dividing lines from one pole to another; and the filings will group themselves in such manner as to bridge this gap. By trying to fan the filings from one place to another the observer will quickly discover where they cling most tenaciously and where not at all. It is necessary only to consider the molecules of a piece of work on the same chuck as a mass of iron filings, impelled to do just what the actual filings have accomplished but failing because of their immobility, in order to determine the value of that chuck as a work holder for the pieces under consideration.

This test was tried upon many experimental chucks before Mr. Arter finally adopted the present design. Some of them were of the single-magnet type and others were not, but of them all the one shown appeared to the designer to more nearly meet his requirements. It may be noted in Fig. 134 that the actual circumference of the chuck does not attract the iron filings; indicating that there is practically no leakage of magnetic flux at this point.

One of the experimental chucks is shown in Fig. 135 and its behavior under the filings test in Fig. 136. The body of this chuck is a forged ring of machine steel. The central pole is a mushroom-shaped piece of soft steel, the upper part nearly filling the shell while the stem accommodates the coil.

Narrow slots, represented in the cut by the parallel bars, were milled clear across the top surface of the chuck; the slots in the core being made wider and deeper than where they crossed the rim of the shell, to provide space for the white metal that separates parts of opposed polarity.

Narrow steel strips were then forced into the slots in the shell and the white metal divider poured in around them where they crossed the central portion.

The filings show an almost normal condition except that one side of each crossbar is much less strongly magnetic than the other, and this condition was unerringly shown after repeated trials, so that it could not have been an accidental disposition of the filings. The filings also indicate a very weak chuck whereas the chuck was a more than ordinarily powerful one, but with very peculiar characteristics. Some of the joints where the crossbars were driven into the shell show magnetic flux where, so well was the mechanical work done, no joint was visible to the naked eye, and where there should have been no magnetism even though the joints were badly made. Further, a test with the dipping needle showed some of the bars almost neutral and others of the wrong polarity; a condition which the filings would not indicate.

The chuck seemed to be surrounded by a strong flow of conflicting magnetic currents that were capable of making their influence felt at a distance of several inches. Figs. 137 and 138 show two casual experiments with a smaller chuck of similar construction. The piston ring, laid upon the chuck in a certain place would rise to the position shown when the current was turned on, while in some others it would be strongly held in a normal manner and in still other positions would hardly be held at all. The scissors could not be made to rise from a horizontal position, but when placed as shown in Fig. 138 would not only stand upright but would sway to and fro when blown with the fan. A needle suspended by a thread could be made to float horizontally, at a distance of four to five inches above the surface, upon the invisible flow of magnetism as a cork floats upon water. If pushed a fraction of an inch below the neutral point it would be drawn to the surface; if raised a similar distance it would float entirely clear from the chuck and in falling would be drawn sharply back in an elliptical path to the side of the chuck.

As a magnetic chuck, this experiment was a pronounced failure, but as a demonstration of what magnetism will do when there is an unknown condition present it was very interesting.

Danger of Compulsory Metric Standards

From the Report of the Standardization Committee of the American Supply and Machinery Manufacturers Association at Atlantic City, May 17

By H. S. DEMAREST
Greene, Tweed & Co., New York

WE THINK that it might be well to point out in this connection the danger of any hasty consideration and compulsory adoption by our Government of the metric system of weights and measures, as there are some very active advocates of the metric system now bringing pressure upon Congress to adopt it in all Government work, with the expressed intention of making that the entering wedge leading to the universal use of the metric system throughout this country.

I should like to quote from a very exhaustive paper prepared and read by Henry R. Towne before the American Society of Mechanical Engineers, entitled "Our Present Weights and Measures and the Metric System."

"In the United States, the Federal Constitution, according to Act 1, sec. 8, par. 5, gives to Congress the power, 'To fix the standard of weights and measures,' although, as pointed out by Hallock and Wade in their recent volume, 'The Evolution of Weights and Measures,' this is, 'almost the only power expressly and specifically conferred on Congress, which that body has refrained from exercising down to the present time.'

"By an Act passed July 28, 1866, Congress provided that 'it shall be lawful throughout the United States of America to employ the weights and measures of the metric system.' Although it has thus been lawful for more than forty years, for any one who so desires to use the metric system of weights and measures in the United States, the people have not seen fit to avail themselves of the permission, but, in their industry and commerce, have adhered, with absolute uniformity, to their established standards."

Necessity of Investigation

No such changes, however, even where they do not affect the base of the system, should be adopted until, after exhaustive investigation, the effect of the proposed changes, on all industries and interests concerned, shall have been duly ascertained, nor until all interests which would be affected thereby have had due opportunity to submit their views and to explain the difficulties, if any, which they believe would arise from the proposed action.

What France chiefly needed and sought was uniformity, as is shown by the decree sanctioned August 22, 1790.

Germany, also in chaotic condition, each of its 40 states having its own standards, followed the example of France by appointing a commission in 1860, and by the adoption in 1871 of the metric system.

But neither the United States nor Great Britain has any such need or motive for change. Each already has that which other countries chiefly sought in making the change, uniformity, and by changing they would lose it.

In the case of the United States no such impelling necessity exists. We now possess fixed standards and national unity. In other words, we already have those blessings the want of which has led other nations to adopt new standards. Still more, we have also international unity (except as to measures of volume) with the whole of the British Empire, with commercial China and with many other countries, all of which we would sacrifice, temporarily, if not permanently, in case we should abandon our present system.

We now have uniformity. Should we not hold it as a priceless treasure?

The old units would exist in every machine, in every structure, and in innumerable articles of daily use, and no matter how superior the new system might be to the old, the impossibility of immediately bridging the gulf between the two would remain.

A law so revolutionary in its character should only be enacted in response to a clear, if not an overwhelming, public demand. No evidence is adduced to show that any such demand exists.

The Cost to Manufacturers

As stated by Henry R. Towne, when a witness at one of the recent hearings before the House Committee on Coinage, Weights and Measures, "One thousand millions of dollars would not cover the ultimate cost to the manufacturers of the United States of the compulsory adoption of the metric system in the resulting changes in their equipment of machinery, tools and gages." It would hardly be an exaggeration to state that in some cases such an enforced change would mean bankruptcy to the manufacturer.

France in 1801 had no such conditions to deal with, nor did Germany even in 1871. Modern industry, especially in the United States, is largely the creation of the last fifty years. What might have been easy in 1801, or feasible in 1871, has become almost impossible today. The proposed change would vitiate all existing Anglo-Saxon engineering literature.

It is urged, as a chief argument in favor of the metric system, that it would promote our export trade. Has the non-use of the metric system retarded the growth of our exports of manufactures? Has the non-use of English measures by France and other metric countries operated to decrease our imports of manufactures from such countries? If they should abandon the metric system tomorow, and substitute for it the British-American system, would our purchases of their manufactures thereby be increased?

As a matter of fact there is no recognized or visible demand from our export merchants, or from the foreign merchants to whom they sell, that we should discard our present system of weights and measures and adopt the metric system.

It is Henry R. Towne's conviction that our adoption of the metric system would not perceptibly increase our exports to metric countries and that it would handicap our export trade to other countries which offer us the largest markets. So long as England maintains her present standards we would need to maintain our existing units of measurement, wholly or in part, for all goods made for British markets.

Turning now to the effects of such a change on the business transactions of the Government itself, the fol-

lowing may be pointed out as conditions which should at least be studied carefully before we commit ourselves to such a momentous change, viz.: (1) It would disqualify for a long time probably 95 per cent of the present army of Government clerks from doing their work efficiently; (2) it would for many years add greatly to the time and cost of all Government accounting, and to the army of Government employees; (3) it would greatly increase the tendency to error; (4) it would make the Government reports for a long time unintelligible to the people; (5) it would preclude comparison of past with future records and statistics; (6) it would preclude ready comparison of our statistics with those of the British Empire; (7) it would make void the engineering and technical formulas which our Government engineers (Army and Navy), naval constructors, architects, etc., have used all their lives; (8) it would compel the Government or the seller, in every transaction, so long as the metric system was used by the Government only, to express every detail of such transaction in terms of both systems; (9) it would compel the Government, in order to obtain commercial products, to describe them in alien terms but in interminable fractions.

Effects of the Change

The proposed change would greatly increase the operating expenses of all departments of the Government, would almost destroy the value of Government statistics for popular use, and would bring no compensating benefit of any kind. It would substitute confusion for the perfect uniformity which now prevails.

No other nation in the world, save Great Britain, enjoys today such absolute uniformity as to weights and measures as the United States.

The change, if made and if enforced, ulimately would involve a loss or injury to American manufacturers of probably more than $1,000,000,000, with no compensating benefit which they can perceive.

We think that these salient points brought out by Mr. Towne in his paper will furnish you with abundant food for thought on this important subject.

Disposing of Scrap Without Trouble

"Every now and then when I see an advertisement featuring a nice high wire fence," remarked the Old Scout, yesterday, "I think of the old Wilson shop in Kokomo, Ind., where I worked some fifteen years ago.

The machine shop stood right on the edge of one of the small but deep stone quarries with which that section is infested, and this quarry was filled with water to a depth (according to the oldest inhabitant) of about forty feet. The shop windows were open most of the time, and wire gratings for windows were a thing of the future, so far as that shop was concerned. The result was that when a piece of work was scrapped, it just simply vanished. A couple of steps in the general direction of the south side of the shop, zowie—splash! That's all. The foreman even caught one of the men on the night gang as he was just about to consign a warped crankshaft, flywheel and all, to the mighty deep of that quarry.

"If that hole has never yet been cleaned out, now would be a good time to do it. There's enough scrap metal in that quarry to pay John D. Rockefeller's income tax."

Women as Business Correspondents

By Rita Smith Remington

The writer has noted with interest J. T. Bartlett's article "Correspondence Supervision" on page 94 of the *American Machinist*, especially that part dealing with women as correspondents.

Within certain limitations women may become good correspondents. It is true that they have as a rule but little knowledge of or interest in machinery. The writer, for example, after twenty-five years of business dictation, much of it in regard to patents and the intimate details of machinery, never takes down the phrase "dogs under the table" without a momentary wonder as to what the dogs are doing there and why they don't come out! Of course she has finally learned, theoretically, that a "dog" is an iron or steel contraption on the end of a whatdoyoucallit, but nevertheless her first thought is as above. One of the good features of shorthand is that one can take down whole pages of dictation and transcribe it accurately, if one has been adequately trained, without the least idea of what it is all about!

We are apt to think of a man's knowledge of tools or machinery as inborn. More often it is acquired. The boy begins to follow his father about and to handle his tools and imitate his actions, driving a nail, planing wood, etc., and by the time he enters school has a fair knowledge of the names of many simple tools (from having been sent on errands after them so many times) and of their uses. His sister, on the other hand, has been with her mother, and knows more about sewing, washing dishes, etc. Her knowledge also, is not inborn; it is acquired. Even so, we have all of us met men with a good working knowledge of housekeeping, and other men who can't put up a curtain so it will stay, or fix the loose knob of a door or set up a stovepipe.

In the large machine shop where the writer is employed the young men starting to work for the company are encouraged to go about the shops, to acquire a knowldge of the company's product, so that they may be able to write a good snappy advertisement, or to dictate correspondence. Why not arrange tours for new stenographers, personally conducted by a competent machinist, who can point out the various machines with their working parts, not exhaustively, but so that the girls may have an idea of what is being dictated, and not labor under the impression that a "dog" must necessarily be the kind named Fido, or Rover? It should be understood that the girls are just as "busy" while on such tours, as if they were typing at their desks. If a stenographer must hurry back to her desk every time she leaves it, what chance has she to learn anything about the machines? She may do as the writer did, pass a group of machines several times each day for four years, without even noticing that there were really two groups of them, until finally enlightened by someone telling her that they were "punch presses and drill presses." Now when she takes a dictation about presses a mental picture of those out in the adjoining room "flashes before her inward eye," and she knows what she is writing about. Woman's natural curiosity, with which she is so widely credited, seems to fail her in a machine shop; she passes machines for years without any hope or expectation of ever knowing anything about them.

If tours as sketched above, with elementary instruction as to the nature and purpose of the machines shown, were arranged for stenographers, "Elsie Snowden" may more than fulfill the expectations of "S. L. Betts."

Slip of Involute Gear Teeth

BY A. B. COX

(Continued from last week's issue.)

FOR the internal gear, formulas similar to the preceding are found in this way: In Fig. 5 the origin has been taken at O', and the length of L_g found as follows:

$$x^2 + y^2 = \rho'^2_A = \left(R - \frac{1}{p}\right)^2$$

$$= R^2\left(\frac{N-2}{N}\right)^2 \text{ from equation of circle.}$$

The equation of the line of action is $y = R - x \tan \phi$.

$$y^2 = (R - x \tan \phi)^2.$$

Substituting this value of y^2, we have

$$x^2 + R^2 - 2Rx \tan \phi + x^2 \tan^2 \phi = \frac{R^2}{N^2}(N^2 - 4N + 4).$$

$$x^2N^2 + N^2R^2 - 2N^2Rx \tan \phi + x^2N^2 \tan^2 \phi = N^2R^2 - 4NR^2 + 4R^2.$$

$$x^2N^2 \sec^2 \phi - 2N^2Rx \tan \phi + 4R^2(N-1) = 0.$$

$$x = \frac{2RN^2 \tan \phi \pm \sqrt{4R^2N^4\tan^2\phi - 16N^2R^2\sec^2\phi\,(N-1)}}{2N^2\sec^2\phi}$$

$$= \frac{R}{\sec \phi}\left[\sin \phi + \sqrt{\sin^2\phi - \frac{4}{N^2}(N-1)}\right].$$

The quantity within the brackets has been represented for convenience by Z_1.

$$L_g = x \sec \phi = RZ_1 = KrZ_1. \quad (46)$$

$$\rho_A = \sqrt{r^2 + L_g^2 - 2rL_g \cos(90 - \phi)}$$

$$= \sqrt{r^2 + K^2r^2Z_1^2 - 2Kr^2Z_1 \sin \phi}.$$

$$H_A = \sqrt{1 + K^2Z_1^2 - 2KZ_1 \sin \phi}.$$

$$\theta'^2_A = [(1 + K^2Z_1^2 - 2KZ_1 \sin \phi) \sec^2 \phi - 1].$$

$$\theta_A^2 = [(K^2Z_1^2 - 2KZ_1 \sin \phi) \sec^2 \phi + \tan^2 \phi].$$

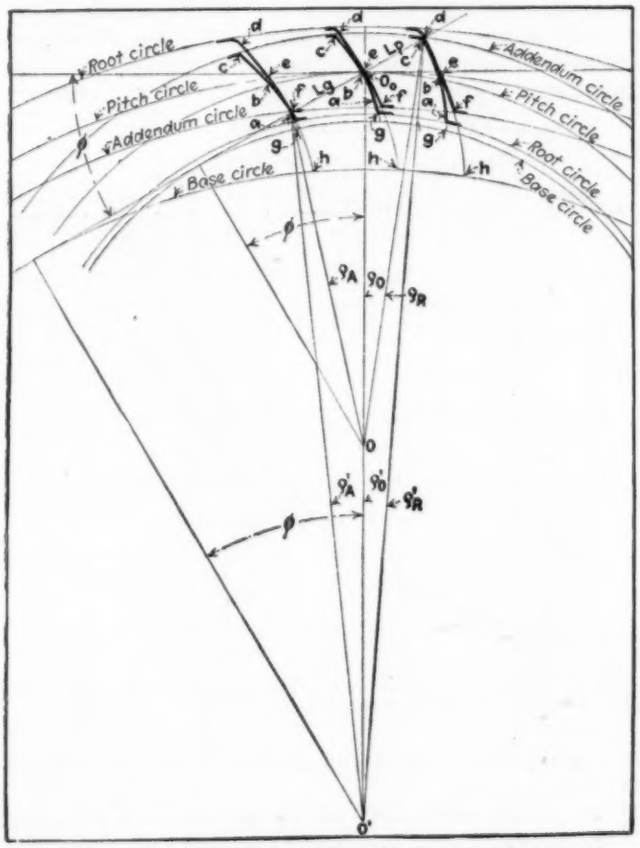


FIG. 5. DIAGRAM FOR INTERNAL GEAR FORMULAS

Length of involute ag

$$= \frac{r \cos \phi}{2}[K^2Z_1^2 - 2KZ_1 \sin \phi) \sec^2 \phi + \tan^2 \phi]. \quad (47)$$

Length of involute $bg = \frac{r \cos \phi}{2} \tan^2 \phi.$ (48)

Length of involute $ab = bg - ag.$

$$= \frac{r \cos \phi}{2}\left[\tan^2\phi - (K^2Z_1^2 - 2KZ_1 \sin \phi)\sec^2\phi - \tan^2\phi\right]$$

$$= \frac{r \sec \phi}{2}[2KZ_1 \sin \phi - K^2Z_1^2]. \quad (49)$$

$$\rho'_A = R - \frac{1}{p} = R\,\frac{(N-2)}{N}.$$

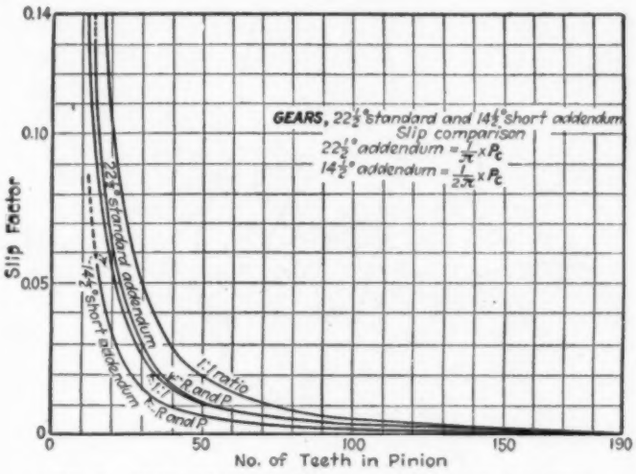


FIG. 6. SLIP COMPARISON, 14½-DEG. AND 22½-DEG. INVOLUTES

$$\theta'^2_A = \left(\frac{N-2}{N}\right)^2 \sec^2 \phi - 1.$$

Length of involute $hf = \frac{R \cos \phi}{2}\left[\left(\frac{N-2}{N}\right)^2 \sec^2 \phi - 1\right]$

$$= \frac{R \cos \phi}{2}\left[\left(\frac{N^2-4N+4}{N2}\right)\sec^2\phi - 1\right]$$

$$= \frac{R \cos \phi}{2}\left[-4\,\frac{(N-1)}{N^2}\sec^2\phi + \tan^2\phi\right] \quad (50)$$

Length of involute $eh = \frac{R \cos \phi}{2} \tan^2 \phi$ (51)

Length of involute $cf = eh - hf.$

$$= \frac{R \cos \phi}{2}\left[\tan^2\phi + 4\,\frac{N-1}{N^2}\sec^2\phi - \tan^2\phi\right]$$

$$= \frac{R \sec \phi}{2}\left[\frac{4(N-1)}{N^2}\right]$$

$$= \frac{r \sec \phi}{2}\left[\frac{4K(N-1)}{N^2}\right] \quad (52)$$

Slip of approach $= ef - ab$

$$= \frac{r \sec \phi}{2}\left[\frac{4K(N-1)}{N^2} - 2KZ_1 \sin \phi + K^2Z_1^2\right] \quad (53)$$

$$L_p = rZ_p = \frac{RZ_p}{K}.$$

$$\rho'_R = \sqrt{R^2 + L_p^2 - 2RL_p \cos(90 + \phi)}$$

$$= \sqrt{R^2 + \frac{R^2Z_p^2}{K^2} + \frac{2R^2Z_p}{K} \sin \phi}.$$

$$H'_R = \sqrt{1 + \frac{Z_p^2}{K^2} + \frac{2Z_p \sin\phi}{K}}.$$

$$\theta''_R = \left[\left(1 + \frac{Z_p^2}{K^2} + \frac{2Z_p \sin\phi}{K}\right)\sec^2\phi - 1\right].$$

$$\theta''_R = \left[\left(\frac{Z_p^2}{K^2} + \frac{2Z_p \sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right]$$

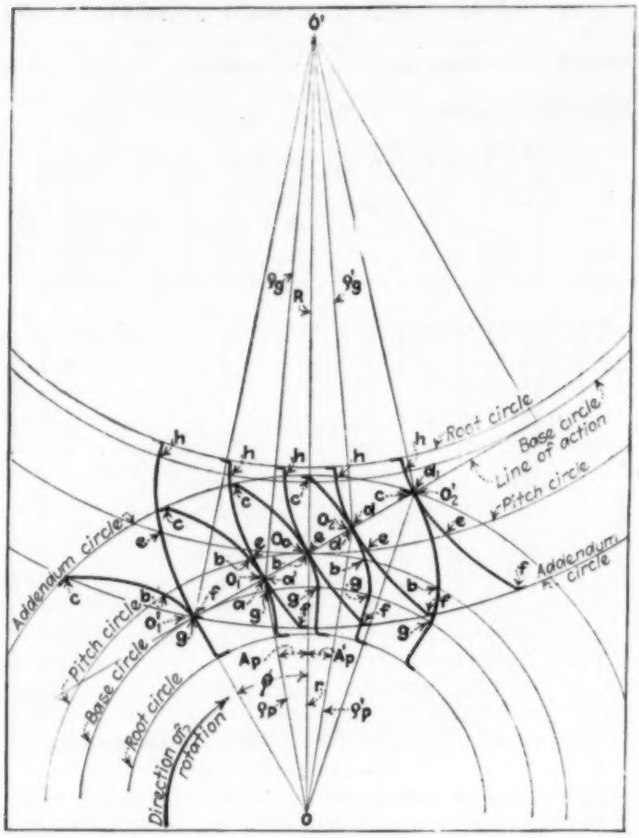


FIG. 7. DIAGRAM FOR CALCULATION OF SLIP FORMULAS

Length of involute dh

$$= \frac{R\cos\phi}{2}\left[\left(\frac{Z_p^2}{K^2} + \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi\right] \quad (54)$$

Length of involute $he = \frac{R\cos\phi}{2}\tan^2\phi$ (55)

Length of involute $de = dh - he$,

$$= \frac{R\cos\phi}{2}\left[\left(\frac{Z_p^2}{K^2} + \frac{2Z_p\sin\phi}{K}\right)\sec^2\phi + \tan^2\phi - \tan^2\phi\right]$$

$$= \frac{K\,r\sec\phi}{2}\left[\frac{Z_p^2}{K^2} + \frac{2Z_p\sin\phi}{K}\right]$$

$$= \frac{r\sec\phi}{2}\left[\frac{Z_p^2}{K} + 2Z_p\sin\phi\right] \quad (56)$$

Length of bc is same as (40) $= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2}\right]$ (57)

Recess slip $= bc - de$

$$= \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2} - \frac{Z_p^2}{K} - 2Z_p\sin\phi\right] \quad (58)$$

Total slip = (53) + (58)

$$\text{Total slip} = \frac{r\sec\phi}{2}\left[\frac{4(n+1)}{n^2} - \frac{Z_p^2}{K} 2Z_p\sin\phi + \frac{4K(N-1)}{N^2} - 2KZ_I\sin\phi + K^2Z_I^2\right]. \quad (59)$$

The net length of rolling contact $= ab + de$

$$= \frac{r\sec\phi}{2} 2KZ_I\sin\phi - K^2Z_I^2 + \frac{Z_p^2}{K} + 2Z_p\sin\phi\Big]. \quad (60)$$

(59) and (60) were divided by r to obtain the factors of sliding and rolling contact and these were also plotted in Fig. 3, and the ratio of rolling to sliding contact plotted in Fig. 4. It is interesting to note that this ratio is much greater than external gear ratios of rolling to sliding contact and is also a straight line.

If the addendum "A" be expressed as a fraction "q" of the circular pitch, $A = qPc = \frac{2\pi qr}{n}$, the formulas (31) and (42) become:

$$\text{1 to 1 total slip} = 4r\sec\phi\left[\frac{2(n\pi q + \pi^2q^2)}{n^2} - Z\sin\phi\right] \quad (31\text{-a})$$

$$\text{or } 4r\sec\phi\,Z^2 \quad (31\text{-b})$$

where $Z = -\sin\phi + \sqrt{\sin^2\phi + \frac{4}{n^2}(n\pi q + \pi^2q^2)}$,

and rack and pinion total slip =

$$\frac{r\sec\phi}{2}\left[\frac{\pi^2q^2\operatorname{cosec}^2\phi}{n^2} + \frac{n^2 + \pi q}{n^2} - \frac{Z\sin\phi}{2}\right]. \quad (42\text{-a})$$

Since "q" for standard length teeth $= \frac{1}{\pi}$ these reduce to (31) and (42) when $\frac{1}{\pi}$ is substituted for "q." In Fig. 6, the slip factors for 14½-deg. involute gears with $q = \frac{1}{2\pi}$ have been plotted together with similar curves for 22½-deg. involute standard length teeth to afford some sort of comparison between the effect of decreasing the slip of gearing by using greater angles of obliquity for the line of action and by decreasing the length of addendum. The former method, of course, increases the pressure on the bearings, a disadvantage which the latter method does not have.

The slipping of the teeth is, of course, not at the same rate through the whole arc of contact, it being greatest at beginning contact, zero on the line of centers, and greater again at leaving contact. In order to show this in curve form, the slip formulas have been developed

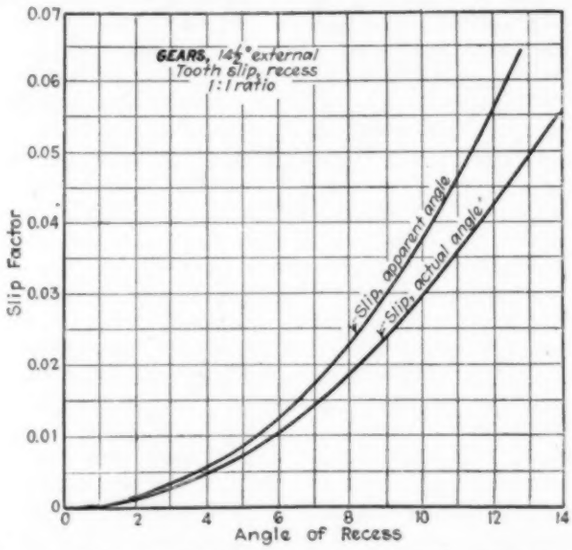


FIG. 8. SLIP FACTORS PLOTTED AGAINST ANGLES OF RECESS FOR 14½-DEG. GEARS OF 1 TO 1 RATIO

in another way. Referring to Fig. 7, this is done as follows:

The pinion tooth first makes contact with the gear tooth at point O'_p, and leaves contact at point O'_g

Points O_1 and O_2 are any positions of the point of contact of the teeth as it moves along the line of action when the pinion is driving the gear in the direction shown. A line $Ob = \rho_p$ drawn to point O_1 makes an angle A_p with the line of centers OO'.

The angle $OO_2O_1 = 90 - \phi$ (63)

and angle $OO_1O_2 = 180 - (90 - \phi) - A_p = 90 + \phi - A_p$.

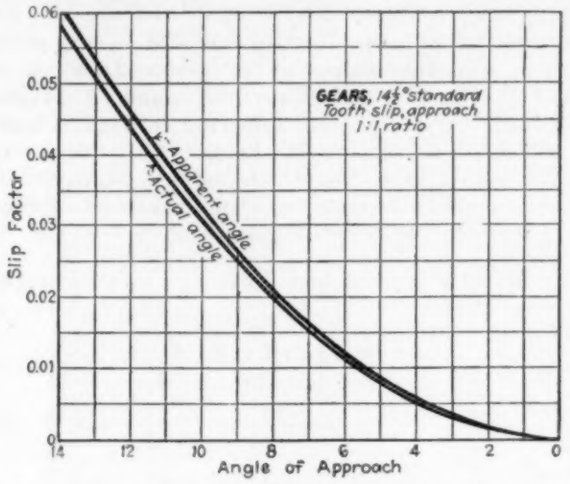


FIG. 9. SLIP FACTORS PLOTTED AGAINST ANGLES OF APPROACH FOR 14½-DEG. GEARS OF 1 TO 1 RATIO

By trigonometry

$$O_1O_2 = L_g = \frac{r \sin A_p}{\sin [90 + (\phi - A_p)]},$$

$$L_g = \frac{r \sin A_p}{\cos(\phi - A_p)}.$$

Angle $O_1O_2O' = (90 + \phi)$.

$$\frac{\rho_p = r \sin (90 - \phi)}{\sin [90 + (\phi - A_p)]} = \frac{r \cos \phi}{\cos (\phi - A_p)}.$$

$$H_p = \frac{\cos \phi}{\cos (\phi - A_p)} = \frac{\rho_p}{r}.$$

$$\theta_p^2 = H_p^2 \sec^2 \phi - 1 = \left[\frac{\cos^2 \phi \sec^2 \phi}{\cos^2(\phi - A_p)} - 1\right]$$

$$= [\sec^2 (\phi - A_p) - 1] = \tan^2 (\phi - A_p).$$

Length of involute $ag = \frac{r \cos \phi}{2} \tan^2 (\phi - A_p)$. (64)

Length of involute $gb = \frac{r \cos \phi}{2} \tan^2 \phi$. (14)

Net length of acting involute $ab = gb - ag$

$$= \frac{r \cos \phi}{2} [\tan^2 \phi - \tan^2 (\phi - A_p)]. \quad (65)$$

$$\rho_g = \sqrt{R^2 + L_g^2 - 2RL_g \cos (90 + \phi)}.$$

$$R = Kr.$$

$$\rho_g = \sqrt{K^2 r^2 + \frac{r^2 \sin^2 A_p}{\cos^2(\phi - A_p)} + \frac{2K r^2 \sin \phi \sin A_p}{\cos (\phi - A_p)}}$$

$$= r \sqrt{K^2 + \frac{\sin^2 A_p}{\cos^2 (\phi - A_p)} + \frac{2K \sin \phi \sin A_p}{\cos (\phi - A_p)}}.$$

$$H_g = \frac{\rho_g}{R} = \frac{\rho_g}{Kr} = \sqrt{1 + \frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}}.$$

$$\theta_g^2 = \left[\left(1 + \frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right)^2 \sec^2 \phi - 1\right]$$

$$= \left[\left(\frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right)^2 \sec^2 \phi + \tan^2 \phi\right].$$

Length of involute $ha' =$

$$\frac{R \cos \phi}{2} \left[\left(\frac{\sin^2 A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right) \sec^2 \phi + \tan^2 \phi\right] \quad (66)$$

Length of involute $he = \frac{R \cos \phi \tan^2 \phi}{2}$ (67)

Length of acting involute $ea' = ha' - he$.

$$\frac{R \cos \phi}{2} \left[\left(\frac{\sin A_p}{K^2 \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{K \cos (\phi - A_p)}\right) \sec^2 \phi + \tan^2 \phi - \tan^2 \phi\right]$$

$$= \frac{r \sec \phi}{2} \left[\frac{\sin^2 A_p}{K \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{\cos (\phi - A_p)}\right] \quad (68)$$

Approach slip = (68) — (65)

$$\frac{r \cos \phi}{2} = \left[\left(\frac{\sin^2 A_p}{K \cos^2 (\phi - A_p)} + \frac{2 \sin \phi \sin A_p}{\cos (\phi - A_p)}\right) \sec^2 \phi - \tan^2 \phi + \tan^2 (\phi - A_p)\right]. \quad (69)$$

Similarly $\rho'_p = \frac{r \sin (90 + \phi)}{\sin [90 - (\phi + A'_p)]} = \frac{r \cos \phi}{\cos (\phi - A'_p)}$.

$$H'_p = \frac{\cos \phi}{\cos (\phi + A'_p)}.$$

$$\theta'^2_p = \left[\frac{\cos^2 \phi}{\cos^2 (\phi + A'_p)} \sec^2 \phi - 1\right] = \sec^2 (\phi + A'_p) - 1$$

$$= \tan^2 (\phi + A'_p).$$

Length of involute $gd' = \frac{r \cos \phi}{2} \tan^2 (\phi + A'_p)$ (70)

Length of involute $gb = \frac{r \cos \phi}{2} \tan^2 \phi$ (71)

Acting length of pinion involute $bd =$

$$\frac{r \cos \phi}{2} \left[\tan^2 (\phi + A'_p) - \tan^2 \phi\right] \quad (72)$$

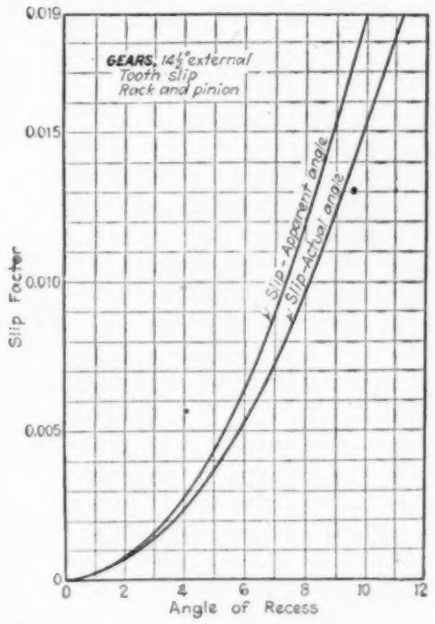


FIG. 10. SLIP FACTORS PLOTTED AGAINST ANGLES OF RECESS FOR 14½-DEG. RACK AND PINION

By trigonometry

$$O_1O_2 = L_p = \frac{r \sin A'_p}{\sin [90 - (\phi + A'_p)]} = \frac{r \sin A'_p}{\cos (\phi + A'_p)}.$$

$$= \rho'_g \sqrt{R^2 + L_p^2 - 2RL_p \cos (90 - \phi)}$$

$$= \sqrt{K^2 r^2 + \frac{r^2 \sin^2 \phi}{\cos^2 (\phi + A'_p)} - \frac{2 K r^2 \sin \phi \sin A'_p)}{\cos (\phi + A'_p)}}$$

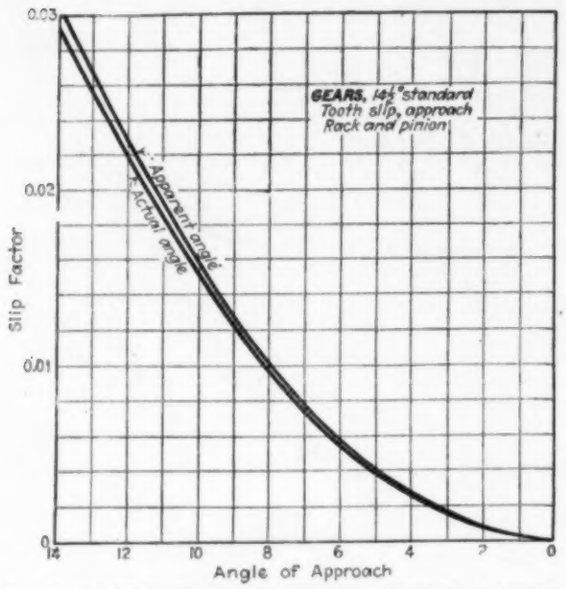


FIG. 11. SLIP FACTORS PLOTTED AGAINST ANGLES OF APPROACH FOR 14½-DEG. RACK AND PINION

$$H'_\theta = \frac{\rho'_\theta}{R} = \frac{\rho'_\theta}{Kr} = \sqrt{1 + \frac{\sin 2 A'_p}{K^2 \cos^2 (\phi + A_p')} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)}}.$$

$$\theta'^2_\theta = \left[\left(1 + \frac{\sin^2 A_p}{K^2 \cos^2 (\phi + A'_p)} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi - 1 \right]$$

$$= \left[\left(\frac{\sin^2 A'_p}{K^2 \cos^2 (\phi + A'_p)} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi + \tan^2 \phi \right].$$

Length of involute $hd' =$

$$\frac{K r \cos \phi}{2} \left[\left(\frac{\sin^2 A'_p}{K^2 \cos^2 (\phi + A'_p)} \right) - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi + \tan^2 \phi \Big] \quad (73)$$

$$\text{Length of involute } he = \frac{K r \cos \phi}{2} \tan^2 \phi \quad (74)$$

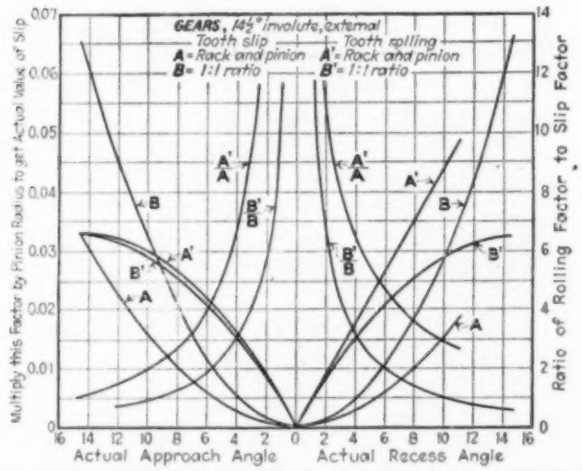

GEARS, 14½° involute, external
Tooth slip
Tooth rolling
A = Rack and pinion
B = 1:1 ratio
A' = Rack and pinion
B' = 1:1 ratio
Multiply this Factor by Pinion Radius to get Actual Value of Slip
Ratio of Rolling Factor to Slip Factor
Actual Approach Angle
Actual Recess Angle

FIG. 12. CURVES OBTAINED BY CORRECTING THE CURVES IN FIGS. 8 AND 9 TO ACTUAL ANGLES OF APPROACH AND RECESS

$$\text{Length of acting involute} = he - hd' = d'e$$

$$= \frac{Kr \cos \phi}{2} \left[\tan^2 \phi - \left(\frac{\sin A'_p}{K^2 \cos^2 (\phi + A'_p)} - \frac{2 \sin \phi \sin A'_p}{K \cos (\phi + A'_p)} \right) \sec^2 \phi - \tan^2 \phi \right]$$

$$= \frac{r \cos \phi}{2} \left[\frac{2 \sec^2 \phi \sin A'_p \sin \phi}{\cos (\phi + A'_p)} - \frac{\sin^2 A'_p \sec^2 \phi}{K \cos (\phi + A'_p)} \right] \quad (75)$$

$$\text{Recess slip} = (71) - (75)$$

$$= \frac{r \cos \phi}{2} \left[\tan^2 (\phi + A'_p) - \tan^2 \phi - \left(\frac{2 \sin A'_p \sin \phi}{\cos (\phi + A'_p)} - \frac{\sin^2 A'_p}{K \cos^2 (\phi + A'_p)} \right) \sec^2 \phi \right]. \quad (76)$$

Formulas (69) and (76) were divided by the pinion radius r, successive values of A_p' assumed and curves plotted in Figs. 8 and 9 for the standard 14½-deg. tooth for 1 to 1 ratio. By referring to Figs. 3 and 4 (in "Angles of Approach, Recess and Contact of Involute Gears," *American Machinist*, vol. 54, page 559) these curves were corrected to actual angles of approach and recess and the resulting curves plotted in Fig. 12.

For the case of rack and pinion, $\frac{1}{K} = O$, and (69) becomes:

$$\text{Approach slip} = \frac{r \cos \phi}{2} \left[\frac{2 \sin \phi \sin A_p \sec^2 \phi}{\cos (\phi - A_p)} - \tan^2 \phi + \tan^2 (\phi - A_p) \right] \quad (77)$$

and (76) becomes:

$$\text{Recess slip} = \frac{r \cos \phi}{2} \left[\tan^2 (\phi + A'_p) - \tan^2 \phi - \frac{2 \sec^2 \phi \sin A'_p \sin \phi}{\cos (\phi + A'_p)} \right] (78)$$

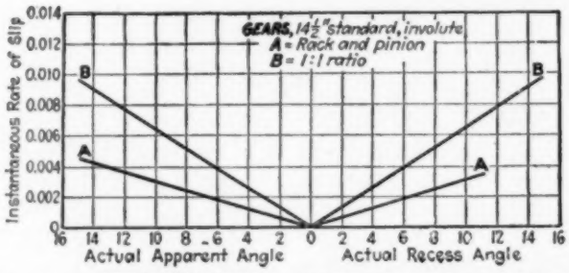


FIG. 13. INSTANTANEOUS RATE OF SLIP PLOTTED AGAINST ACTUAL ANGLES OF APPROACH AND ACTUAL ANGLES OF RECESS FOR 14½-DEG. RACK AND PINION AND GEARS OF 1 TO 1 RATIO

$$\text{Approach rolling contact} = ab \quad (65)$$

$$\text{and recess rolling contact} = de \quad (75)$$

For 1 to 1 ratio, approach rolling =

$$\frac{r \cos \phi}{2} \left[\tan^2 \phi - \tan^2 (\phi - A'_p) \right] \quad (79)$$

and recess rolling =

$$\frac{r \cos \phi}{2} \left[\frac{2 \sec^2 \phi \sin A'_p \sin \phi}{\cos (\phi + A'_p)} - \frac{\sin^2 A'_p \sec^2 \phi}{\cos^2 (\phi + A'_p)} \right] \quad (80)$$

For rack and pinion, approach rolling =

$$\frac{r \cos \phi}{2} \left[\tan^2 \phi - \tan^2 (\phi - A'_p) \right] \quad (81)$$

$$\text{and recess rolling} = r \tan \phi \frac{\sin A'_p}{\cos (\phi + A'_p)} \quad (82)$$

These have been plotted similarly to (69) and (75) in Figs. 10, 11 and 12 and the ratio of rolling to slipping plotted against angle of approach and recess.

It will be noted that the length of addendum and the number of teeth of pinion or gear do not appear in these latter formulas. Hence they are good for any number of teeth and any length of addendum.

The ordinates of these curves show the total slip of approach or recess for any set of gears having the particular value of approach and recess angle at which the ordinates are read. The curves have been differentiated to obtain the instantaneous slip as plotted in Fig. 13.

Curves for other gear ratios will of course fall between those shown for 1 to 1 ratio and for rack and pinion.

In conclusion, it may be said that the methods and formulas here used may be extended to cover various other problems of gearing, but the foregoing have seemed to be of more general interest. The theoretical efficiency of gearing can be calculated by using the factors of slip and rolling contact and the number of teeth in contact from Fig. 3 (see "Derivation of a Formula to Determine Number of Teeth in Contact of Two Meshing Gears," *American Machinist*, Vol. 53, page 899) with the coefficients of rolling and sliding frictions plus bearing friction. The pressure on the bearings will, of course, be affected somewhat by the tooth friction. The formula for curvature of the involute is quite simple (radius of curvature $= r_b\theta$).

The outstanding lessons of the data and curves here worked out are that the efficiency can be greatly increased and the wear as greatly decreased by simply choosing large numbers of teeth. The use of shorter addendum gears, or greater obliquity of the line of action reduces slip and increases the percentage of rolling contact, or, stated in another way, allows smaller numbers of teeth—coarser pitches—with the same wear. The gain in efficiency from increasing the angle of obliquity is more and more offset by the increased friction losses in the bearings as the angle increases. The shortest addendum possible and the smallest angle of obliquity consistent with the pitch demanded for strength of teeth would seem to be the most nearly ideal solution. It should be noted in this connection that the strength of short addendum teeth is very much greater than standard addendum teeth and correspondingly finer pitches can be used.

The Stanley Steam Car Power Plant

Flexible Power Plant—Welded Tubes and Head in Wire Wound Boiler—Grinding Reversing Links—Test Stand for Finished Engines

By Fred H. Colvin
Editor, *American Machinist*

STEAM automobiles of various kinds have come and gone and it is significant that the only one which has survived the test of time is the pioneer of them all, the Stanley steamer, as it is familiarly known. This is built by the Stanley Motor Carriage Co., Newton, Mass., in the original location but with greatly enlarged buildings and increased equipment.

The flexibility of the steam driven car is secured by two simple steam cylinders having 4-in. bore and 5-in. stroke. These cylinders are double acting and give as many impulses per revolution as an 8-cylinder, 4-cycle internal combustion motor. A steam pressure of from 575 to 600 lb. is normally carried, giving ample power under all conditions. The two essential features are, therefore, the boiler and the engine, which will be shown in some detail.

The boiler is of the fire tube type having a drawn shell, as shown in Fig. 1. This view shows drilling the holes for the tubes, about 650 in all, in the solid end of the shell by means of a plate j g. A tube plate is welded in the other end of the shell after both are drilled and properly lined up.

FIG. 1. DRILLING THE SOLID HEAD OF BOILER

FIG. 2. WELDING REINFORCING RING AND TUBES

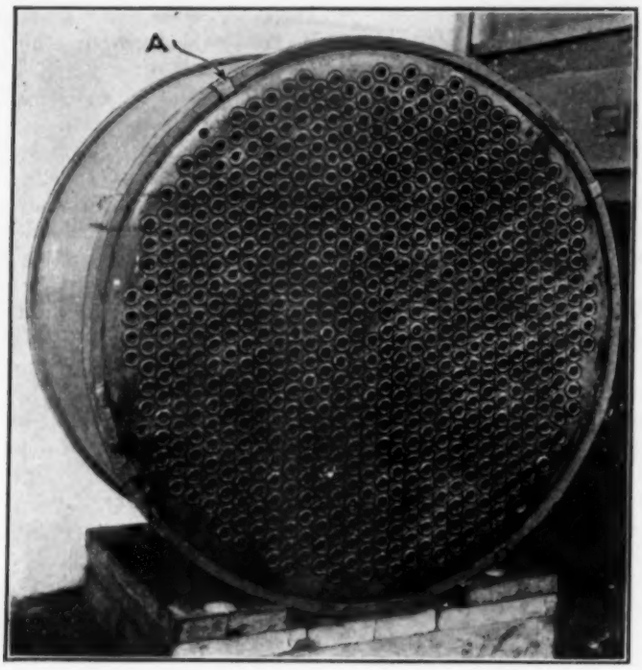


FIG. 3. BOILER WITH TUBES WELDED

The boiler tube holes in the solid head and in the plate are easily lined up by placing the boiler on its side, putting the plate in position and inserting two rods through similar holes in both head and plate. These rods project at each end and it is an easy matter to determine when the holes are in line. The plate is then welded in position with an oxyacetylene torch.

Heads Are Reinforced

Both heads are reinforced by steel bands as shown in Figs. 2 and 3. Fig. 2 shows the reinforcing bands at the open end of the shell being welded into position. Fig. 3 also shows the boiler tubes welded in place and it will be noted that the ring on this end (which is the one drawn solidly with the shell) has four retaining plates, as at *A*, which are also welded to the shell. The band at this end of the shell is shrunk in place and is not welded to the shell.

It will be noted that the bottom tube sheet has been recessed around each tube hole. This allows the metal from the welding wire to flow into the recesses and make the tube practically a part of the sheet itself.

The other ends of the boiler tubes can be seen in Figs. 4 and 5. These tubes project through the top head and are reinforced with steel bushings, after which they are flanged, making it impossible for them to pull through the head. It must also be remembered that each of the boiler tubes acts as a sort of safety valve in itself, as the tube will collapse and leak at a pressure less than one half of that necessary to rupture the boiler. The tubes are Parkerized to prevent rust.

Winding Wire on Boiler

One of the special features of the Stanley boiler is the winding on the outside of the shell with a wire of very high tensile strength, about what is known as piano wire in most shops, similar to cannon construction. This wire is approximately 0.050 in. in diameter and is wound on in a lathe specially rigged up for this work, as shown in Fig. 4. This view shows the first layer being wound. There are three layers in all, using approximately a mile of wire on each boiler. Suitable tension is provided and the wire is fed along by the carriage so as to insure an even layer in each case. The winding is about twenty-two layers to the inch and the reinforcement gives the boiler a combined strength greater than if it was built of ⅜-in. steel.

After the boiler has been completely wound and the end of the wire tacked in place it goes to the testing room, where it is filled with water and subjected to test over a burner mounted on a suitable stand, as can be seen in Fig. 5. Each boiler is subjected to the test of 900 lb. of steam pressure and 1,600 lb. of water pressure before being passed for assembly in the chassis. This test allows for a good factor of safety and boiler explosions never occur.

As before stated, the motive power is a simple two-cylinder double acting steam engine, the Stephenson

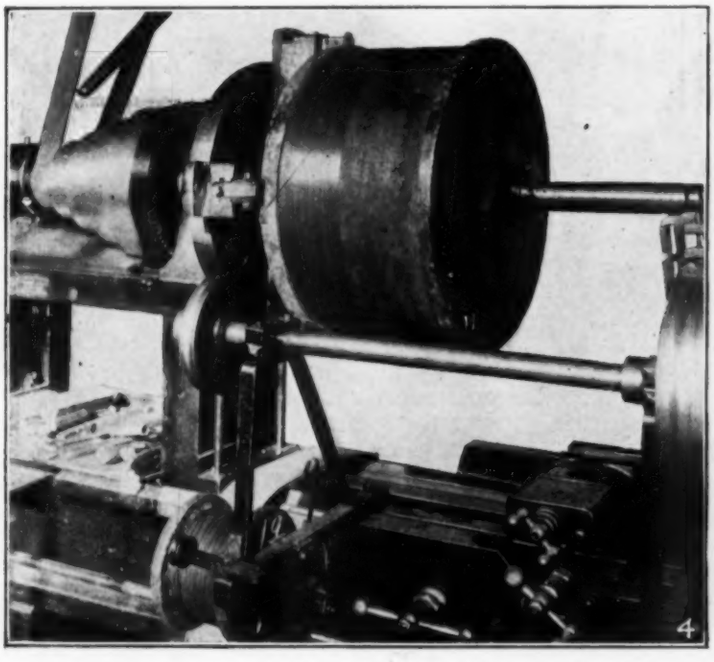
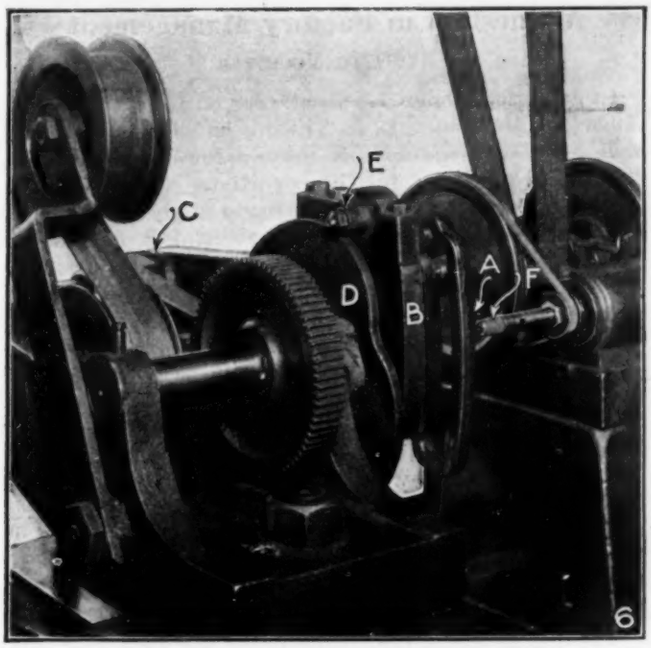


FIG. 4. WINDING THE BOILERS FIG. 5. TESTING BOILER UNDER STEAM PRESSURE



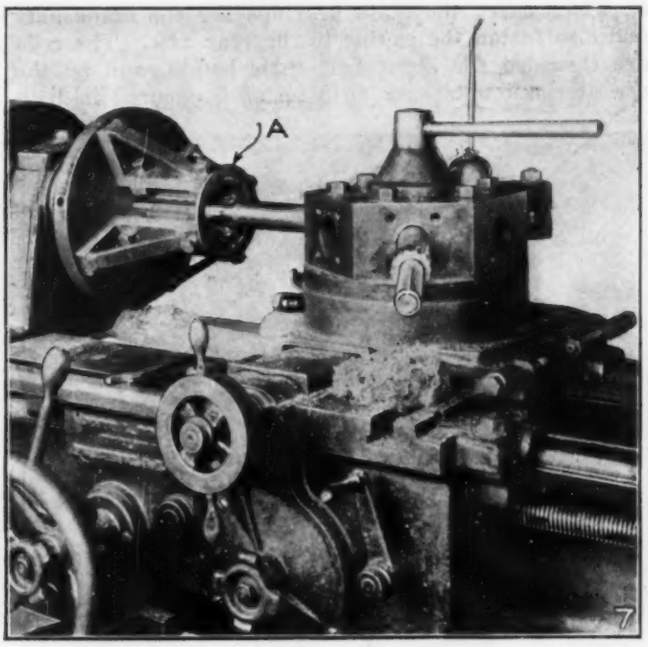


FIG. 6. GRINDING THE LINKS. FIG. 7. BORING THE CROSSHEAD GUIDES

link and slide valve being used for steam distribution. The method of grinding this link is shown in Fig. 6 and is interesting because of its simplicity. The link *A* is a forging which is located on the plate *B* by the eccentric rod holes. This plate is pivoted at *C* and is free to move up and down under control of the heart-shaped cam *D*. The roller *E* simply rides on the edge of the cam. The whole link carrying mechanism is supported in the toolblock of a lathe and can be adjusted back and forth for grinding both of the curved surfaces of the link.

The grinding wheel is mounted on a separate block bolted to the lathe bed. The lathe carriage is moved lengthwise on the bed to bring the work in contact with the small grinding wheel *F*. In operation the link swings up and down past the grinding wheel as the cam *D* revolves. The cam is driven by the belt and gearing shown at the left, while the grinding spindle is driven by its own belting, as can be readily seen.

The crosshead guides are bored in the fixture shown in Fig. 7. The guides are bolted to the jaws on the face plate, the outer ends being supported by the ring *A*, which prevents spring and adds to the general steadiness during the operation. The fixture carries two pairs of guides which are held in the same relative position as in the engine frame.

The burner is a cast-iron plate of special section as shown in Fig. 8 and contains about 4,500 holes, made with a No. 54 drill. This job is a serious problem in production as the drill breakage is fairly high, being from eighteen to twenty-four drills per plate. While the plate shown is being drilled with a single spindle, a gang drilling machine is used where it is advisable to do so.

The indexing of the burner is accomplished by the two slides *A* and *B*, which give motion in both directions. Cross motion is secured by the indexing crank C, the index plate being in the form of a five pointed star.

Longitudinal motion from one hole to the next is accomplished by the treadle *D*. The combination gives the operator complete control of the burner so far as locating the holes is concerned.

Testing the Engines

The completed engine is shown in Fig. 9, mounted on the test stand, where it is run for three hours under load before being assembled in the chassis. This view shows the general construction and the way in which the load is applied to the engine by means of the prony brake at *A*. The test stand is arranged to take several engines at once, each being supplied with its own brake. The engine frame consists of the four rods *B*, *C*, *D* and

FIG. 8. DRILLING THE BURNER

E, which carry the main bearings for the crankshaft and also fasten the engine to the rear axle. The rods are threaded for about half their length, and by the use of check nuts easy adjustment is secured in both

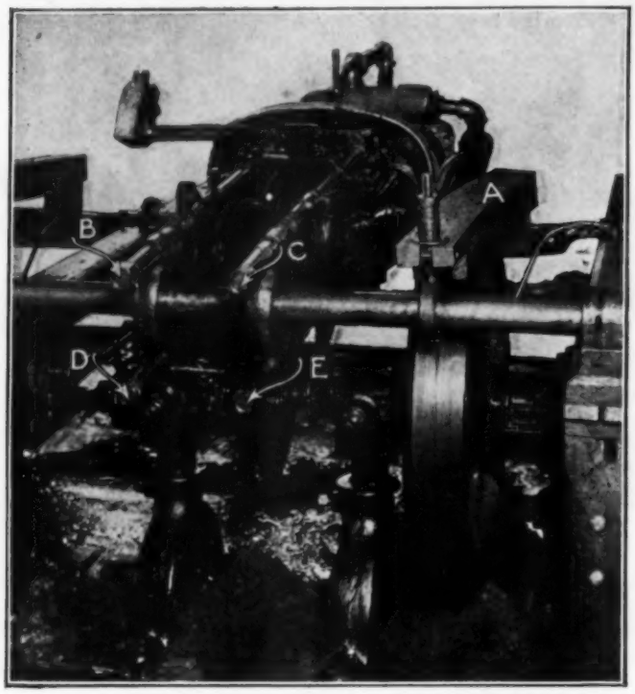


FIG. 9. RUNNING TEST OF COMPLETED ENGINE

places. The meshing of the driving gear on the crankshaft with the driven gear on the rear axle is easily controlled in this way.

An oil tight case surrounds the engine and the central portion of the rear axle, which carries the differentials, so that the engine and gears run in an oil bath at all times. The simplicity of the motor and the driving mechanism is one of the attractive features of this type of automobile power plant. Incidentally, the success of the Stanley car is a good example of the advantages of sticking to one thing and not scattering one's interest in too many directions. It is no small distinction to be a successful survivor.

Wasting Time by Failure to Be Specific

By R. W. Burgess

The following advertisement recently appeared in a technical paper:

> Man wanted, thoroughly acquainted with the manufacture of fans and blowing machinery. Address with full information.

After reading the above seemingly serious advertisement the writer marvels at the range of positions it covers. To answer the same one need only be one of the following: A shop clerk, cost accountant, production engineer, time study man, designer, draftsman, machinist, toolroom or shop foreman, superintendent or general manager.

When the Want Ad writer learns to be specific he will probably hasten the time when the employer and employee will be able to get together to their best possible advantage.

Charles Steinecke's article, *American Machinist*, page 548, shows the proper spirit. BE SPECIFIC.

A Question in Factory Management

By Otto Vogetzer

In an article under the above title on page 422 of the *American Machinist*, L. L. Thwing handled the subject well, and I will endeavor to make a few suggestions in the line of a remedy for the conditions pointed out.

The writer has had opportunity to study the general behavior of young men in the mechanical field after they had been graduated from a technical institution of some kind and were just starting out upon their careers as mechanical engineers or factory managers, with more or less hope of realizing their ambitions.

The young man who falls by the wayside is not necessarily lacking in ambition, he gets into the slough of despond because he is handicapped from the start; he believes himself to be a finished product upon leaving "Tech." He may possess knowledge in abundance but has not had the opportunity to acquire experience and judgment, without which his knowledge amounts to nothing. This state is perfectly natural, but he is ignorant of it; he has been deliberately misled and has started at the wrong end.

The future executive should enter the shop first and after rubbing elbows with the different types of men for a few years and getting first-hand the inside dope of a manufacturing organization, he will have laid a foundation sufficiently solid to weather the storms of disappointment in the future. He will have acquired a determination in proportion to his ambition which he could not acquire in school.

Entering a technical institute after a few years of shop life, the young man is prepared to take his studies seriously, realizing how much is required of the successful executive. After being graduated he has a definite plan of attack because of his previous experience, and is not a total stranger, so to speak. Our embryo executive will not start out with the idea that the world awaits the graduate with open arms and a fat salary. Right here is where some young men receive the hardest blows of disappointment from which so few recover.

The present-day graduate departs from the seat of learning with a valuable fund of information or knowledge, according to his ability of absorbing (to fail to admit this, would be unfair to teacher and student) but he still has to learn how to apply and use the information and formulas, which is not the easy task it appears to be at first.

Something may be said here about the raw material for future executives. We have all heard the following about a man—"He is a born leader." I hate that remark; it means nothing. If we knew the truth about this born leader of men, it would probably turn out that he has acquired most points that make a leader by self-training, by patient application of principles, and by hard work. I do not claim to be able to state all the tangible and intangible qualities a good executive should possess, but I do know that the man who habitually shirks responsibility will never amount to anything, regardless of any good points that he may have and I defy anyone to contradict that statement.

Who has not met the fellow who always says: "It was not my fault," or "I couldn't help it, the machine is at fault" and so on? Anything and everything is wrong except him. That man is doomed to failure. He who is willing and anxious to be responsible for anything he undertakes to do will succeed. Slackers and shirkers please note.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Why Some Motors Give Trouble

BY FRANK C. HUDSON

There is one point in the building of internal combustion motors that is not always given the consideration it deserves. And that is the boring and grinding

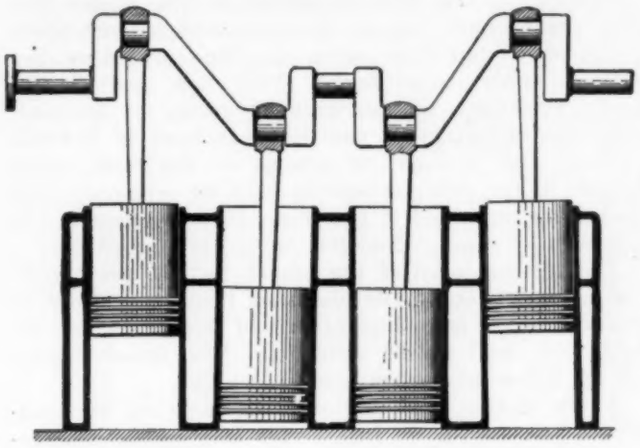


FIG. 1. EFFECT OF CYLINDERS OUT OF SQUARE

of the cylinders square with the crankshaft, particularly in the fore and aft direction. Of course the same thing is true with a steam engine or any combination of a crank and sliding motion, but it applies especially in the case of the automobile motor.

It only takes a glance at the figure, which shows an exaggerated case of the cylinders being out of line. The side stresses on the pistons and connecting rods and the alternating stresses on the crankshaft, all cause unnecessary friction, which means wear, loss of power and trouble.

Of course every maker is sure that this error cannot exist with his motor. But the experience in many large repair shops and in the army, shows that it is a real trouble. It only takes a few thousandths of an inch out of square to produce considerable wear and this means that the internal friction is much higher than it should be. Army experience showed that after this error was eliminated in the repair shops, the motors were much better and ran much longer before requiring repairs.

The remedy is not quite as simple as it may seem. In the case of an engine base and separate cylinder block it means first getting the crankshaft bore parallel with the cylinder surfaces and, second, getting the cylinder holes square with the face of the cylinder block. A little dirt under the face in either the boring or grinding fixture, will throw it out of square.

It is also necessary to see that the slides of the boring and grinding machines are in line with the spindles, and the fixture faces set square with the spindles and ways. An error of a few thousandths of an inch in this direction is more disastrous than a like amount in either diameter, roundness or uniformity of bore. The rings will take care of some variation if the piston moves squarely with the crankshaft.

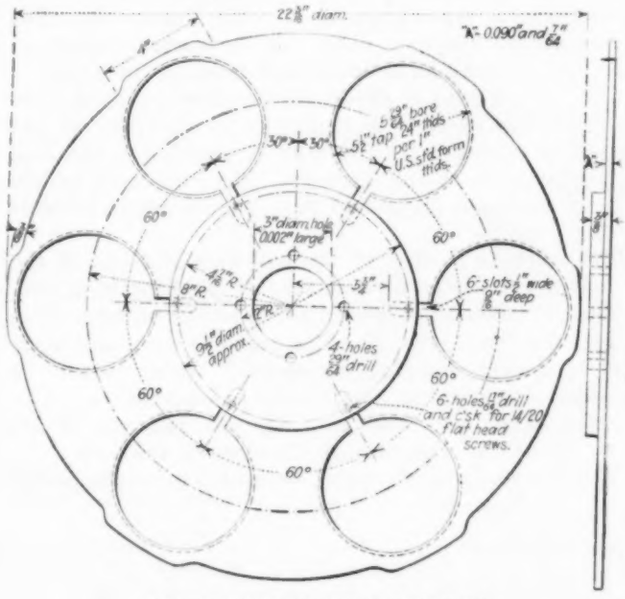
Individual cylinders remove one source of error as the face can be surfaced square with the bore at the same operation, and also ground at the same setting if necessary, by using a special wheel. The chance of error comes in the engine base. Motors with the bases and cylinder blocks cast solid have but one chance of error but this one chance should be carefully watched.

Radial squareness, that is the bores of the cylinders not having sidewise inclination, is of little consequence. Even a variation of the cylinders with each other in this respect is not important, although that is not likely to occur. But squareness lengthwise can not be watched too carefully. It well repays in the life and satisfactory performance of the motor.

How Would You Machine This Disk?

BY P. ARTER

We are having some difficulty in machining the brass disk shown in the accompanying sketch, and it has occurred to us that some of the readers of the *American Machinist* may have had a similar problem on their



BRASS DISK TO BE MACHINED

hands which they have solved more satisfactorily than we have.

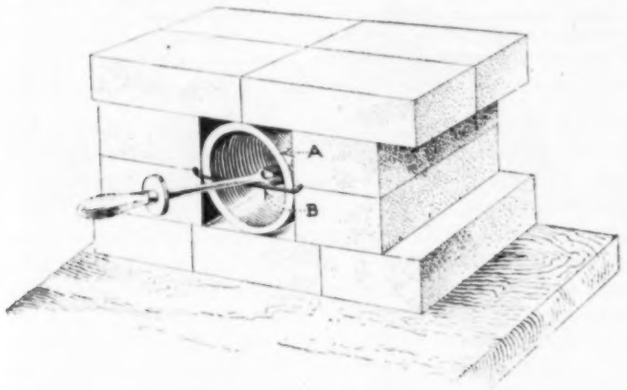
The disk is machined on both sides, which must be as nearly parallel as possible.

We will be glad if any of the readers of the *American Machinist* can tell us of a good way to machine the disk without distorting it.

A Muffle for Heating Soldering Irons

By Frank C. Hudson

A neat method of heating soldering irons was recently seen in a garage at Point Pleasant, N. J. An old Ford piston was surrounded by bricks as shown



HEATING SOLDERING IRON IN GARAGE

in the illustration at *A*. This brickwork was built against the side of the shop and on the work bench.

A heavy piece of wire fastened across the open end of the piston between the bricks at *B* supports the shank of the iron as shown. By placing a gasoline blow torch so that the flame plays on the copper head, the iron is heated with little loss of heat. The hollow piston acts as a muffle, the solid head preventing the flame reaching the side of the building.

Broaching Lock Cylinders

By Carl H. Briggs

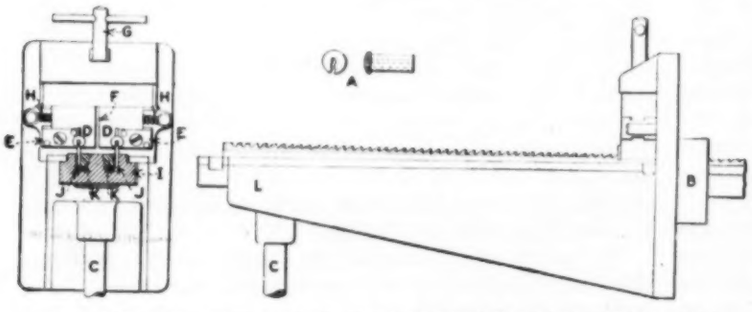
One of the interesting applications of the broaching process is the machining of the keyslots in lock cylinders of the general type shown at *A* in the illustration. The design of the slot may differ for the various makes of locks but the method of broaching remains the same.

The fixture used is shown in the accompanying illustration. The fixture is mounted on the face of the broaching machine by the plug *B* which fits the hole in the faceplate of the machine. The over-hang, nearly 2 ft. in length, is supported by the leg *C* which extends to the floor.

The machine used is of the pull type and two of the cylinders are slotted at each pass of the broaching tool.

The cylinders are inserted between the movable jaws *D* and the fixed jaws *E*. The movable jaws are actuated by a cam clamping device at *F* which in turn is operated by turning the clamping spindle *G*. The springs at *H* open the jaws for the removal of the work, when the clamping mechanism is released.

The broach is made up of several component parts; the body *I*, the two blades *J*, and the taper gibs *K*, which clamp the blades rigidly in place in the body. The body is made of cast iron and the entering end is turned and slotted to fit the drawhead of the broaching machine. The whole unit composed of body, blades and gibs, is guided in the ways at *L*. The blades are very thin, being but 0.100 in. thick on their backs.



MACHINE FOR BROACHING KEY SLOTS IN LOCK CYLINDERS

The slots in the cylinders are 0.340 in. deep as measured from the circumference of the cylinder and it will be noticed that these slots have a number of projections from the sides. These projections overlap each other, making it necessary that the broach start its cut at the extreme circumference of the work. For the depth of 0.340 in. a broach 60 in. in length with the teeth spaced $\frac{3}{4}$ in. apart is used. This allows approximately 0.002 in. of material to be removed per tooth.

Because of the delicate design of the blades and their great length they are made in sections, each blade composed of ten 6-in. sections. This procedure has various points in its favor. The short sections are easily machined, the tendency to spring is lessened, excessive distortion in the heat-treatment is guarded against, and in event of several of the teeth being broken in use but one section need be replaced. The blades are machined to the contour of the slots in the cylinders by means of special formed milling cutters.

The cutting speed of the broach is 7 ft. per minute and a production of 100 pieces an hour may easily be maintained. The cylinders are of brass and no lubricant is used in the operation. The broach blades are of 120-point carbon steel.

Three of the short sections that make up the complete blade are shown in the side view of the illustration. The illustration also shows the finish end of the broach as it is passing through the guiding ways.

The broaching of these lock cylinders differs from the usual broaching practice in that no roughed hole or slot is machined in the work preparatory to broaching, the broach forming the slot from a solid piece of material.

Cyanide Hardening for Color

By R. McHenry

Considerable difficulty is experienced by some when attempting to caseharden small tools, screws, nuts, etc., for colors by the cyanide process. The mystery is removed and good results assured without special equipment if a few simple rules are followed.

First, have the work brightly polished with dry emery cloth and free from grease and finger marks. Heat slowly to a dull cherry red—*no hotter.*

Apply cyanide without removing work from furnace or forge. This may be neatly done by holding a fresh lump of the chemical in a second pair of tongs and rubbing or wiping the piece to be hardened.

The cyanide is then allowed to "boil in" for a few seconds. Also, if the work is small and becomes cooled by the application it is kept in the fire until the dark cherry red heat returns to it.

The article treated is now dipped very quickly, to avoid contact with the air and agitated violently in clear water, until cold. Brightening the surfaces with a little machine oil completes the operation and gives the desired case of mottled brown and blue without scale.

Lathe Fixture for Facing Pump Packing Rings

By A. C. Cole

There is a difference of opinion as to how cylinder packing rings for various kinds of duty should be finished; some hold that grinding on a magnetic chuck is the only proper way to insure a true face and others say that facing one side at a time in a split bushing gives the best results, but from a close observation of both methods it will be determined that chucking the casting from which the rings are cut necessarily distorts it. After the rings are cut off with an allowance of stock for finishing, the chucking strain is relieved and the result is a warped ring. Now, if this ring be drawn down on a magnetic chuck and faced, the same warp will appear when the magnetic influence is withdrawn. The principle is exactly the same as though the ring were crowded into a split bushing and faced. When the holding force of the bushing is relieved the ring will be more or less warped and will rock on a faceplate. The sketch shows a device that overcomes all these objections by facing both sides of the ring at the same time without chucking strains. In Fig. 1 is shown a sectional view of the assembled fixture. The plate *A* fits the lathe spindle and is bolted to it by means of the fitted bolts *E* and the parts *B*, *C* and *D*. Segments *C* are free to move radially by means of the steel ferrules *G* which keep same from seizing.

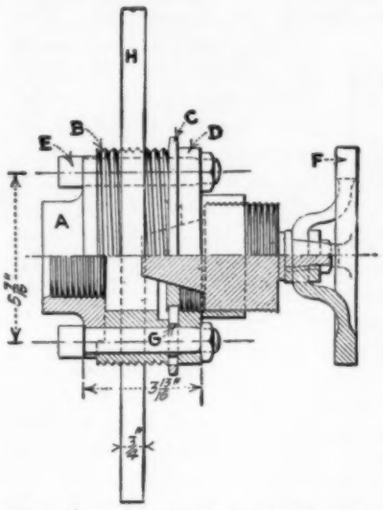


FIG. 1. ASSEMBLED LATHE FIXTURE FOR FACING BOTH SIDES OF PUMP PACKING RINGS SIMULTANEOUSLY

The operations necessary to chuck a ring are as follows: Revolve faceplate *H* on disk *B* so as to square up packing ring which is placed over the segments *C*. Tighten ring by turning wheel *F* clockwise. When the packing ring is sufficiently tight, start the lathe and back the faceplate *H* toward the headstock of the machine; this will allow both inside and outside faces of the packing ring to be cut at the same time by means of a forked tool properly secured in the toolpost. The

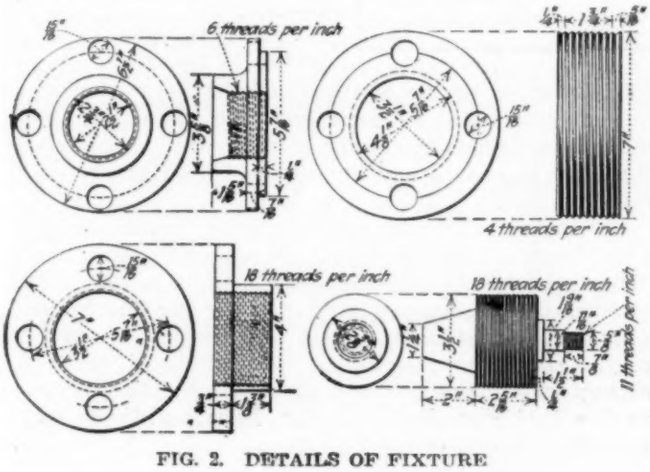


FIG. 2. DETAILS OF FIXTURE

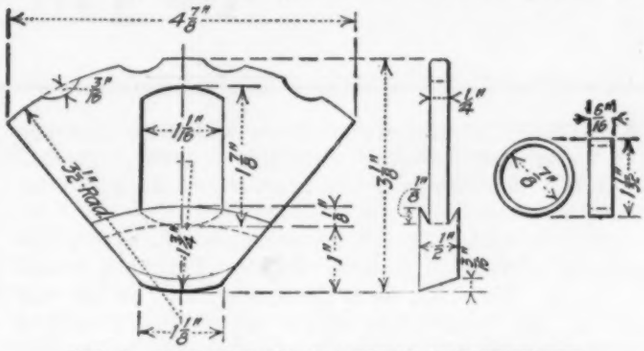


FIG. 3. ONE SIZE OF CLAMPING SEGMENT SET

segments *C* are constructed as shown in Fig 3, so that the width is $\frac{1}{16}$ in. less than the finished width of the packing ring; this will give sufficient tool clearance and allow for inaccurate chucking.

Such a fixture will produce from 200 to 250 rings in 10 hours and each will gage perfectly in any position, thus insuring a perfect fit in the piston grooves. The fixture will hold a number of sizes by making a set of holding segments for each diameter of rings to be machined.

Making Pins With Rolled Heads

By A. A. Karcher

The sketches herewith show the screw machine operations for making pins having rolled heads, one of which is shown in Fig. 1.

Cold-rolled stock of the diameter of the pin body was

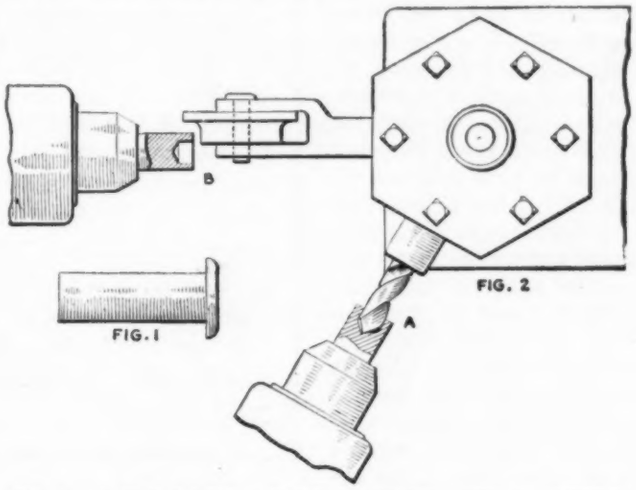


FIG. 1. A PIN WITH A ROLLED HEAD. FIG. 2. TOOLS AND SET UP FOR FORMING THE HEAD

used and the first operation was to drill a shallow hole in the end as shown at *A*, Fig. 2, leaving the walls about $\frac{1}{16}$ in. thick. The size and depth of hole should be governed by the diameter of the stock and the size of the head wanted.

The second operation was to form the head by rolling as shown at *B*. The roller was made of tool steel, hardened, and was about 2 in. in diameter. During rolling a copious flow of cutting solution was used and the result was a highly finished head.

There was practically no waste of material except that required for cutting off.

IN THIS ISSUE

A SURVEY of this week's issue will show that our major articles deal with the following general subjects: Management, manufacturing, design, railroads, automotives.

The first article deals with management, giving the advice of Morgan G. Farrell, of Miller, Franklin, Basset & Co., on "How the Shop Manager Can Use an Appraisal." Mr. Farrell does not go into detail on regard to the method of arriving at values, because, as he sees it, such items as tangent assets, patent rights, financing expenses, etc., "have very little real interest for the executives of industrial plants whose principal care is to produce a suitable return on investments, and who, therefore, want to know in common-sense terms how the fixed portion of their investments stands and how it analyzes for each operating department and each machine." He says further, that an appraisal properly made and used will have a daily value in guiding the policies of the business.

Colvin found an unexpected development of quantity manufacture of oil-well tools in Texas. Beginning on page 932 there are described in his manufacturing article some of the tools used in drilling for oil. The matter of going down for a distance of a mile or so with a drill and still being able to rotate it and make it cut rock would appear to offer more than an average amount of difficulty, and it has, indeed, called forth the ingenuity of those designers who have had the task of producing bits that would do the work. The article shows very clearly the design of these bits and how they are used and it gives a clear idea of the shop requirements necessary to turn them out in quantity and at a moderate cost.

In the current installment of their design article, "Tool Engineering," page 939, Dowd and Curtis furnish more of their very thorough information on drill jig design. This installment includes the design of jig bodies, posts, feet and thumbscrews, as well as locating blocks and types of bushings. A great deal of emphasis is placed upon the fact that many parts of jigs and fixtures can be standardized with the object of obtaining a uniform design or to enable the factory to make them up in quantity which, of course, is necessary in keeping the cost of production of the product down where it should be and in eliminating design expense.

We have been advocating further economy and more efficient equipment in the railroad shops for a long time. Our efforts to effect improvement have been constructive, as we have published, almost weekly, articles that deal with time and labor saving methods in railroad shops. This week, on page 943, there is an article by Stanley which bears the very expressive title, "Saving Materials in Railroad Shops." It deals with recovering lining metal from worn car journal bushings, the methods of lining and boring bearings, and the salvaging of old bolts and air hose. Stanley obtained his data in the shops of the Southern Pacific at Sacramento, Cal.

This week's installment of Ellsworth Sheldon's "Magnetic Chucks" series describes the chuck of the company which he terms the latest entry thus far into the field of manufacture of the magnetic chuck, namely the Persons-Arter Machine Co., Worcester, Mass. Characteristics of the Persons-Arter chuck are its simplicity of construction, its use of a single coil and a distinctive pattern which is shown by the photographs.

The continuation of A. B. Cox's design article on "The Slip of Involute Gear Teeth" begins on page 951. The first part was published last week. It will be remembered that it is the author's intention to show how the efficiency of gears may be increased and the wear decreased, also how to reduce the slip and increase the percentage of rolling contact.

The automotive article which is by Colvin, page 955, describes the power plant of the Stanley steam-driven automobile. The arrangement of the power plant units is explained, the methods of constructing some of them are gone into and the engine tests that are used are described.

The extract from the report of the Standardization Committee of the American Supply and Machinery Manufacturers Association, page 949, is a very clear statement of the danger of adoption by our Government of metric standards, the use of which would be compulsory. The arguments are sound and should serve to strengthen, if possible, the present conviction of our readers that compulsory adoption, as several times heretofore advocated, is not for us.

Coming Features

A short series, unusual in intent and scope, will be begun in out next issue. H. H. Manchester has been delving into history to the extent that he feels that he now can, with confidence, predict what the trend of conditions in the near future will be. He is basing his predictions on what happened after previous wars, giving due consideration to the facts that there never was a war the size of the one just over, nor one that had so many phases. He has called his series "A History in Post War Crises."

Among the several complete articles will be "Heat-Treatment of Thor Tool Parts," by Hunter; "Improved Method of Machining Steel Gears," by Richardson, of the Midvale Steel and Ordnance Co.; "Jig and Fixture Storage," by Colvin; and an article on the installation of motor drives or old railroad shop tools.

There will be installments of "The Foreman and His Job," "Metal Cutting Tools," and "Tool Engineering."

EDITORIALS

Equalization

FOR many months the cry has been for lower prices and a return to normal living. We don't hear so much of lower prices now, everybody is calling for "equalization."

The farmer knows what lower commodity prices mean to the producer and he is strong for having the prices of manufactured goods reduced proportionately. Equalization is vital to his existence. Either the prices of the things he buys must drop to the level of the prices of the things he grows or else the price of farm products must go up again.

Labor in many cases has taken the rather moderate reductions demanded of it in a philosophical way. Where the reduction has been resisted the result is only postponed and will be the same in the end. Wages will not go back to pre-war rates and their decline will be slow. Few employers like to reduce wages and as a consequence the unpleasant job is put off as long as possible.

With supply running far ahead of demand in most lines and wages still high it is only natural that most shops have had to go on short time. It would, of course, be better for the workman to accept a lower wage rate and work full time. He would fare as well for the present and the reduced cost of production would allow his employer to market his product at a lower price, to increase his sales and thus keep his plant running. But with human nature constituted as it is there is small chance that we can get on such a basis very soon.

In the meantime the manufacturer must look elsewhere for an opportunity to lower his production costs. Eliminating the cost of labor as a factor, he must necessarily either reduce the costs of sales and distribution, or increase the productiveness of his equipment. One look at the sales end eliminates that from consideration. From the beginning of the war until a year or so ago the hardest work of the sales force was to fill out the order blanks. No expense was necessary to secure business, it came unasked. But in a buyer's market things are vastly different. Sales expense, then, will go up rather than down.

Distribution costs are probably at their peak now. A little relief may result from the readjustment of rates that seems likely to follow the railroad wage cut promised by the Labor Board, but it will be slight at best and in any case is outside of the control of the manufacturer.

The only salvation, then, seems to lie in an attack on overhead and machinery costs. The tool that costs fifty per cent more but produces three times as much work is a good investment and a real money saver and business producer. Modern shop equipment of every sort must be studied with the utmost care to determine how savings can be accomplished. The design of the product may have to be modified somewhat to take advantage of short cuts but it will be well worth doing.

The key men in this attack on production costs are the designer of the product, the engineer who puts it into production and the machine-tool builder who supplies the machines to turn it out. They must co-operate to the fullest extent if we are to maintain our position as a leading manufacturing country. It must be realized that these statements refer not only to the product "machinery," but to all products made by machinery, because, if traced back far enough, the influence of the machine tool will be found.

As an example of this sort of team work we hear from an automobile plant that a machine tool has at last been conceived to machine a certain part economically that had had to be left partly finished before. As a result the designer has changed the assembly which includes this part and the production engineer is enabled to secure three times the production with the same number of men and a smaller floor space.

If these key men fail, the equalization which is bound to follow will be the increase of commodity prices until a balance is reached. We cannot help but feel that this is not the sort of equalization that is best for the American people. After all, a nation can only exist on the principle of striving for the greatest good for the greatest number of its citizens.

The Balance of Trade Goes Against Us

LAST month's figures show an apparent trade balance against the United States of some seven millions of dollars. This is an occurrence that has long been desired by those who look at economic matters from a world-wide point of view.

Our tremendous export balance which reached into the billions after the war could have but one effect on exchange—the dollar kept climbing to dizzy heights and foreign customers found it ever harder to buy American goods, other than dire necessities, with their depreciated currency. Every machinery manufacturer who formerly had an export market knows this to his cost.

The reversal of the balance means that the world has begun to pay its debts to us and that as a consequence sterling, francs and lire will rise in value until our foreign customers are able once more to purchase the American machinery they so badly need.

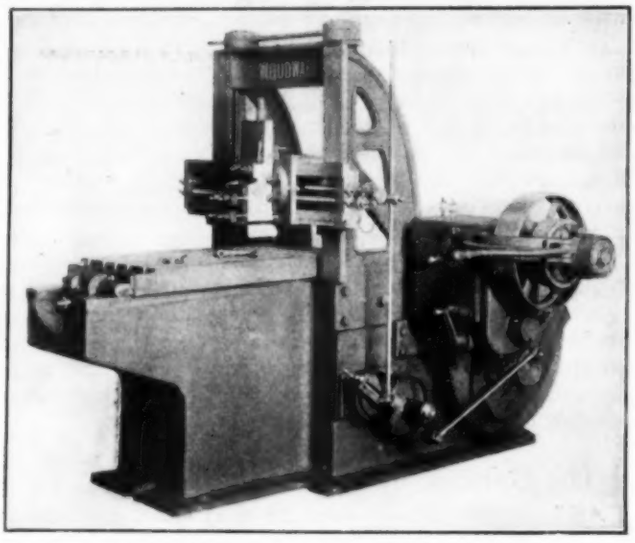
There is no doubt but that as the wheels of industry gather momentum, the world will once more enter upon an era of productiveness. There are cities and factories to be rebuilt, raw and semi-raw materials to be furnished, tools and machinery to be supplied. Countries which before the World War took no great part in the world's commerce, are now developing their industries to the end that they may earn a place in international business. And this means business for American manufacturers and work for American workmen, not only in the final stage of fabrication, but all the way back to raw materials. With it will come stimulation of other lines and another step back to normal business for all.

Too much hope should not be attached to this rather slender thread, for all of Europe is poor and it will be many years before they can hope to reach stability. But there are certain machines and tools that can only be bought here and they represent at least a small volume of business. In times like these every little bit helps.

Shop Equipment News

Woodward & Powell 24 x 24 x 24-Inch Crank Planer

The Woodward & Powell Planer Co., 97 Webster St., Worcester, Mass., has recently placed on the market the crank planer shown in the illustration. The machine



WOODWARD & POWELL CRANK PLANER

Specifications: Stroke, 0 to 24½ in. Height between table and cross-rail, 25 in. Width between housings, 25 in. Table working surface, 40x21 in. Countershaft: tight and loose pulleys, 15 in. in diameter, for 5-in. belt; speed, 240 r.p.m. Strokes per minute of table, 10, 17, 29 and 48. Horsepower of motor required, 5. Ratio of return to cut speed, 1.4 to 1. Floor space required: gear box drive, 80x120 in.; cone drive, 70x120 in. Approximate weight, 8,000 lb.

has a working capacity of 24 x 24 x 24 in. It combines the rigidity of the planer with the ability of the shaper to plane to a line and to operate with short, rapid strokes. It is said to be especially adapted to forge shop and railroad-shop work, handling die blocks, gibs, shoes, wedges, crossheads and slide valves.

The bed, housings and cross-rail are massive and well ribbed, to give rigidity. The table has large flat bearing surfaces on the top of the bed, and is gibbed its full length. The stroke is adjustable for length by a removable crank operating a screw in the crank disk, which is located in the rear of the machine on the shaft of the large driving gear. Any length of stroke up to 24½ in. can be taken over any portion of the table, the position of the stroke being adjusted by means of a shaft at the front end of the table. This adjustment can be made while the table is in motion, if desired. The machine can also be furnished with a stroke of 28½ inches.

The housings are lipped on the bed, and extend down on the sides of it. The arch rests on top of the housings, as well as between them. The head can be swiveled to either side for angular planing, and is graduated in degrees. The saddle is lipped over the cross-rail. The crank can be applied to either end of the rail screw and rod for hand movement. The feeds for cross, vertical, and angular travel are operated by hand or automatically by power and take place on the return stroke.

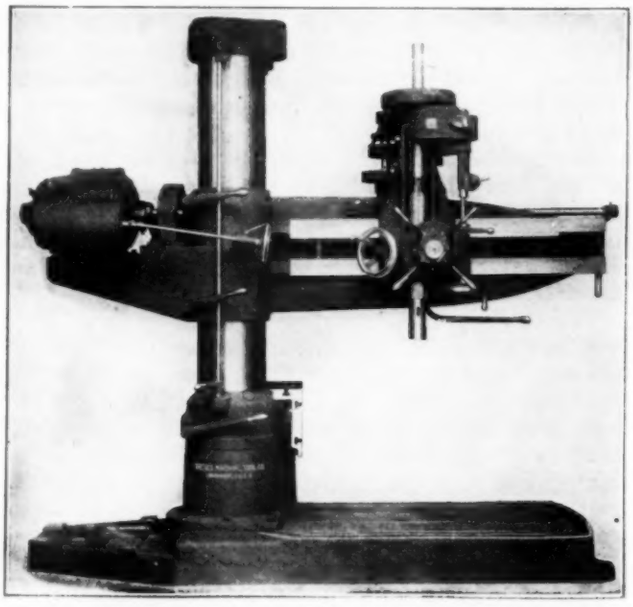
The planer can be operated by belt on a single pulley connected to a four-speed gear box, as shown; or this pulley can be replaced by a gear, and a motor mounted on top of the gear box with a pinion to mesh with the driving gear. A four-step cone pulley can be mounted in place of the gear box. The handle for operating the starting and stopping clutch of the gear-box-driven planer also operates a brake for stopping the table when the clutch is thrown out. All gears and revolving parts are thoroughly guarded, these guards having been removed from the machine illustrated in order to show the working parts to better advantage.

Dreses Motor-on-Arm Drive for Radial Drilling Machine

The driving arrangement shown in the illustration has recently been put on the market by the Dreses Machine Tool Co., 227 West McMicken Ave., Cincinnati, Ohio. The motor, shown fitted to a 5-ft. radial drilling machine made by the concern, drives the drill and also raises the arm. It is mounted on an extension of the arm, so as to partially balance it; and it is placed on a sub-base, so that different makes can be fitted without a change of the arm.

The driving mechanism is very simple. The pinion on the motor meshes directly with a large gear on the horizontal back shaft of the arm. The arrangement thus eliminates two pairs of bevel gears, three spur gears, eight bearings, two long shafts and one short shaft, used in the driving mechanism when the motor is mounted on the machine base. The total friction is said to be reduced to about one-half, so that a motor of one-third less capacity than required on the base of the drill can be used.

The controller is placed in front of the motor, and by means of a universal joint shaft and bracket, the controlling handwheel is brought within easy reach of the operator. The handwheel rim is beveled at an angle of



MOTOR-ON-ARM DRIVE FOR DRESES RADIAL DRILLING MACHINE

45 deg. and graduated to show the spindle revolutions at the different stations of the controller. A fixed pointer, reaching over the handwheel, serves as an indicator. By this arrangement, four sprocket wheels with chains, several brackets with bearings, two bevel gears, and a long shaft, which are necessary when the controller is placed in the rear of the motor and arm, are eliminated.

Powers Duplicating Drilling Machine

The drilling machine shown in Fig. 1, designed by James Powers, has recently been placed on the market by the Sterling Tool and Machine Works, Inc., 205 West 19th St., New York, N. Y. Although adaptable to ordinary drilling, the machine is intended chiefly for the performance of drilling work either requiring the duplication of a part already made, or done directly from a templet or drawing.

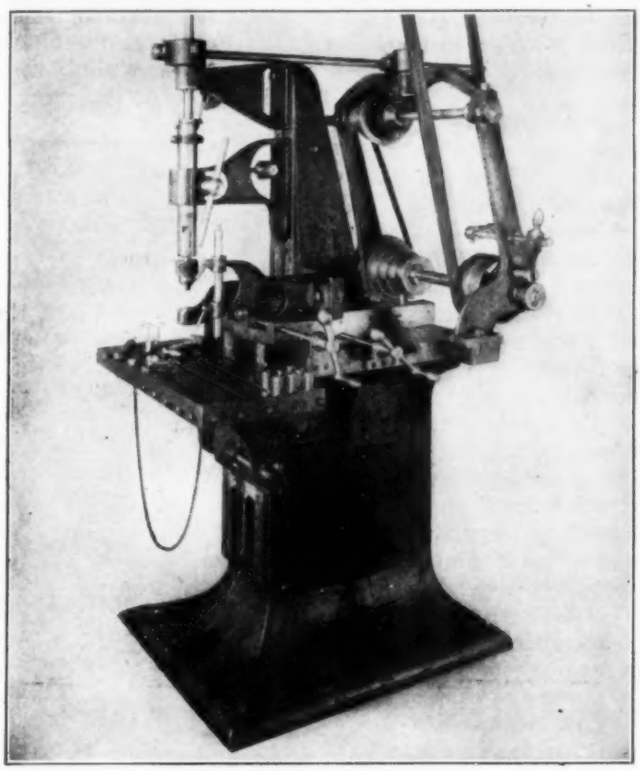


FIG. 1. POWERS DUPLICATING DRILLING MACHINE

Specifications. Capacity, ¼- to ¾-in. drill. Spindle: diameter, 2 in.; taper hole, No. 2, Morse; feed, 5 in. Travel of spindle head: longitudinal, 15 in.; transverse, 8 in. Table: size, 12¼ x 30 in.; vertical movement, 12 in. Speed changes, 5. Height to top of helical gear housing on spindle, 5 ft. 10 in. Floor space, about 3 x 4 ft.

The rectangular table can be adjusted vertically on dove-tailed ways by means of a crank and can be locked in place. Sufficient room is thus allowed for working upon jigs. The head or column carrying the spindle is mounted on ways and can be moved both longitudinally and transversely by means of ball cranks at the right side of the machine. The cranks are fitted with graduated collars, so that the position of the head can be accurately adjusted; and clamps are provided to hold it in position. The screw for the transverse movement is operated through helical gears.

The machine is driven by a belt on tight and loose pulleys, and cone pulleys are provided to afford changes of speed. Because of the fact that the spindle moves in two planes, it is driven through a splined horizontal shaft fitted with helical gears, so that the movement of the spindle is not constricted.

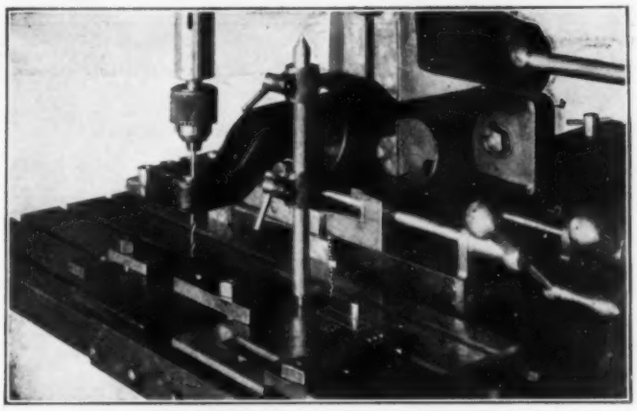


FIG. 2. DUPLICATING THE HOLES IN A JIG PLATE

The spindle is fed by hand and is provided with an adjustable stop. It is counterweighted and carries an adjustable drill chuck. The arm holding the quill can be moved vertically on the column. Another arm carries a bushing for steadying the drill. At the right of the spindle is an arm mounted on the column and holding in two bearings the vertical pilot bar.

The pilot bar is shown in use in Fig. 2. The master plate is clamped on the table under the pilot, and the work to be drilled under the spindle. By positioning either the conical point of the pilot bar or the stud end, bushed if necessary, in the holes of the master plate in turn, and moving the table and the spindle by means of the controls, the holes in the work can be made to duplicate those in the master. This method is said to be very effective for toolroom work and for small quantity manufacture, eliminating the necessity for jigs and fixtures.

In work such as making models, the drawing can be laid directly on the table and the positions of the holes transferred. When duplicating a part to replace a worn or broken one, the holes in the new part might be located by clamping the old part under the pilot and working from it. Holes can be accurately laid out by the ordinary method of buttoning, the buttons being properly positioned with relation to each other and then clamped on the table. The pilot is brought over the buttons in turn, so that the holes can be drilled in the work.

The maker emphasizes the universality of the machine. It may well be used for removing stock from irregularly shaped die blocks. A fixture for drilling holes on the circumference of a circle can be supplied. The machine can be furnished in various sizes to suit different classes of work, the specifications being given for the first model of the machine.

Changes in Pratt & Whitney Measuring Machines

The Pratt & Whitney Co., Hartford, Conn., has added several features to the well-known measuring machines which it manufactures.

A changed design of pedestal for the 36- and 48-in. machines, shown in Fig. 1, retains the rigidity of the older form in a much lighter construction besides furnishing support to the hardwood shelf in front of the machine so that the shelf, while providing a convenient place for the operator to lay tools or pieces upon while

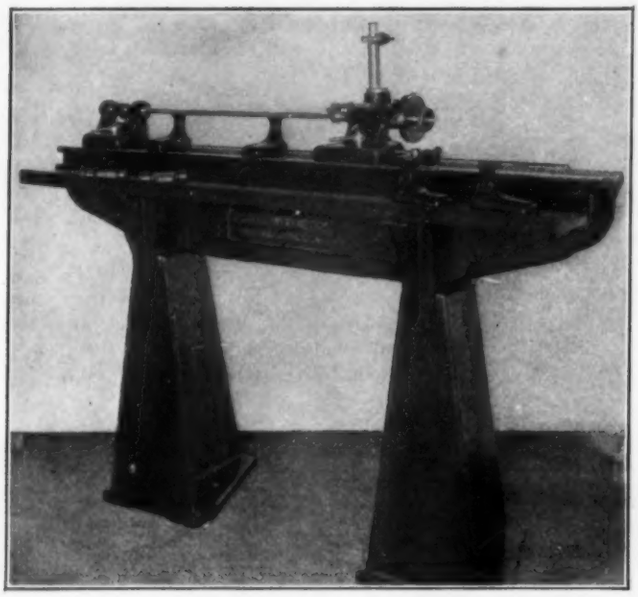


FIG. 1. PEDESTAL FOR PRATT & WHITNEY MEASURING MACHINES

he is engaged, does not at any point come in contact with the bed of the machine.

The measuring head, which may be seen in detail in Fig. 2, is fitted with a clamping arm moved by a tangent screw in the adjustment block so that when the graduation on the dial is brought almost to line, the clamping screw may be tightened, binding the arm to the dial, and the final adjustment made by means of the tangent screw. An adjustably mounted vernier has been added, and also a permanently mounted glass for reading the dial and vernier, thus enabling the operator to make the most minute settings with ease and accuracy.

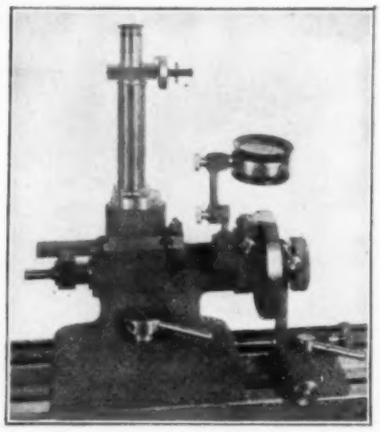


FIG. 2. IMPROVEMENTS TO FACILITATE SETTING

Improvements have also been made in the microscope by means of which the readings from the longitudinal scale are obtained. The eye-piece has been extended and at the lower end of the tube an enclosed electric light is so arranged as to illuminate the graduations on the bar.

Anderson Double Spindle Automatic Nut Tapping Machine

A double-spindle automatic nut tapping machine has been completed by the Anderson Die Machine Co., Iraniston Ave., Bridgeport, Conn., and is now ready for the market. This machine incorporates new features in the reversing type of machine in that it is entirely automotive and has no clutches.

Nuts ranging in size from $\frac{1}{4}$ in. to $\frac{5}{8}$ in. across the flats, from $\frac{1}{8}$ to $\frac{1}{4}$ in. thickness, and any size of hole up to 10-24 may be tapped at a rate of production of from 112 to 136 pieces per minute. The nuts may be either square or hexagon.

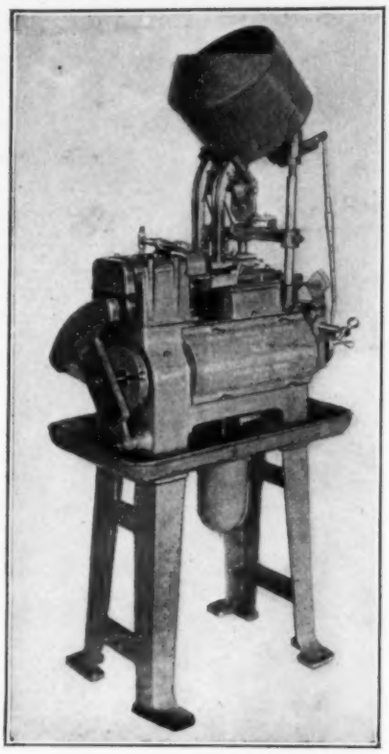
The work is dumped into the hopper shown above the machine in the illustration, and by means of an agitator operated by a crank movement at the rear end of the mainshaft, is fed through the curved chutes, the lower ends of which are fitted with shutters that hold the nuts, one at a time in each chute, in tapping position. The nuts do not leave the chutes until tapped.

A vibrator in the shape of an unbalanced disk running at a high rate of speed, keeps the nuts moving in the chutes and forestalls "hanging up" before the tapping position is reached.

The forward and back rotative movement of the tapping spindles is accomplished by means of a gear and pinion meshing with the reciprocating gear segment which may be seen on the front end of the machine. The segment is reciprocated by the adjustable pin in the crank disk behind it, and the amplitude of the movement is adjusted to give the required number of revolutions of the spindle to insure a full thread in the work.

The segmental gear in connection with the crank disk and sliding block constitutes a Whitworth crank movement that gives a comparatively slow rotative speed while the taps are cutting and a much higher speed for the withdrawal.

The endwise movement of the spindles is under the control of cams on the mainshaft, which extends through the machine. The cams, however, are so designed as to present the taps to the work and release them at the time they start to cut, so that the spindles may float during the time the taps are in the thread. The return cam picks up the movement as soon as the taps are fully withdrawn and carries them back out of the way while the tapped nuts are dropped out of the chutes and others take their place. No special taps are required.



ANDERSON DOUBLE SPINDLE AUTOMATIC NUT TAPPING MACHINE

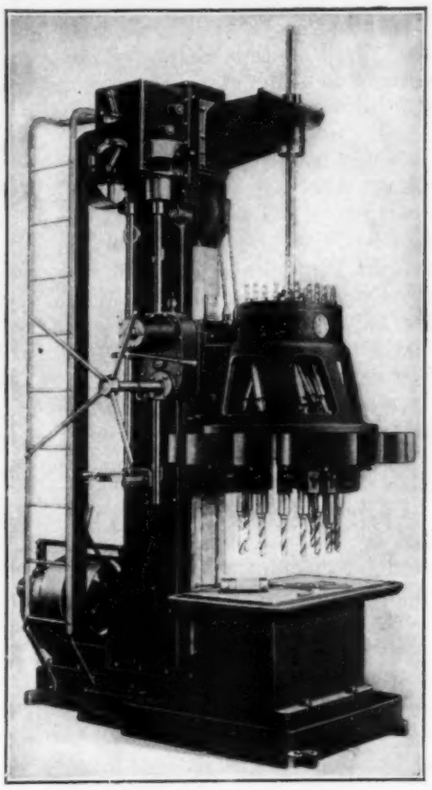
Oil is fed to the taps by a pump in the base of the machine, through hinged spouts so arranged that when they are turned back out of the way for purposes of adjustment the flow of oil is automatically cut off.

The machine is driven by a $\frac{1}{4}$-hp. motor that can be furnished either for alternating or direct current, 110 or 220 volts. The drive is through the medium of a worm with wormwheel keyed directly to the mainshaft.

The net weight of the machine is 500 lb., and it occupies a floor space of 18 x 24 in. The height from floor to center of spindle is 43$\frac{1}{4}$ in., total height 66 inches.

Fox D-32 Multiple-Spindle Drilling Machine

The machine shown in the illustration is the size D-32 which has been added to the line of the Fox Machine Co., Jackson, Mich. In designing the machine provision was made for raising and lowering the spindle head by power, using an Ingersoll-Rand four-cylinder air motor mounted on the head. An interlocking device on the valve controls the air motor so that it is impossible to engage it and the power feed at the same time.



FOX TYPE D-32 DRILLING MACHINE

The machine is shown with a 20-in. round head with twelve spindles, each 2 in. in diameter. However, the machine can be furnished with any one of a variety of heads giving a large range in drilling areas and for many sizes of spindles. The head has been mounted on a saddle in order to obtain a longer bearing on the column ways, and this arrangement aids in absorbing the strains created in forcing the drill into their work.

Sliding gear transmissions are used for feed and speed changes, the gears being of hardened steel and used with shafts mounted on Hyatt roller bearings. The gears are flooded with oil by a pump located at the base of the column. The head can be furnished with two speeds to each spindle and the speeds of all spindles can be independently varied, or when not in use can be thrown into a neutral position. The feed is engaged by a saw-tooth clutch that is automatically disengaged when the head reaches an adjustable stop.

The machine can be equipped with an automatic tapping attachment that has been built so that it is possible to reverse the spindle at any time during the tapping operation, and then instantly change the rotation back to the original direction. The design has been arranged to take the load off from the entire machine and taps when the spindle reversal takes place, in order to make the tapping of blind holes an easier operation and eliminate the shock from the machine. The head of the machine is furnished with a power feed in either direction equal to the lead of the taps, and the direction of the feed is controlled directly by the direction of the spindle rotation.

Rotary tables can be furnished for the machine so that loading can be done at the same time that drilling is progressing under the head. The machine varies in weight from 9,000 to 12,000 pounds.

H. S. & G. Heavy Triple-Geared Lathe

The Houston, Stanwood & Gamble Co., Cincinnati, Ohio, has recently placed on the market a 60-in. heavy triple-geared lathe as shown in Fig. 1. The bed of the lathe, which is 42 ft. long, is made in one section. The large steadyrest shown at the end of the lathe has a capacity of 23 to 37 in., and the smaller steadyrest has a capacity of 2 to 23 in. Both are equipped with bronze shoes on the jaws. The carriage is equipped with a rapid power traverse. The lathe as shown is equipped with a 35-hp. Westinghouse Type SK variable-speed motor, 220 volts, direct current.

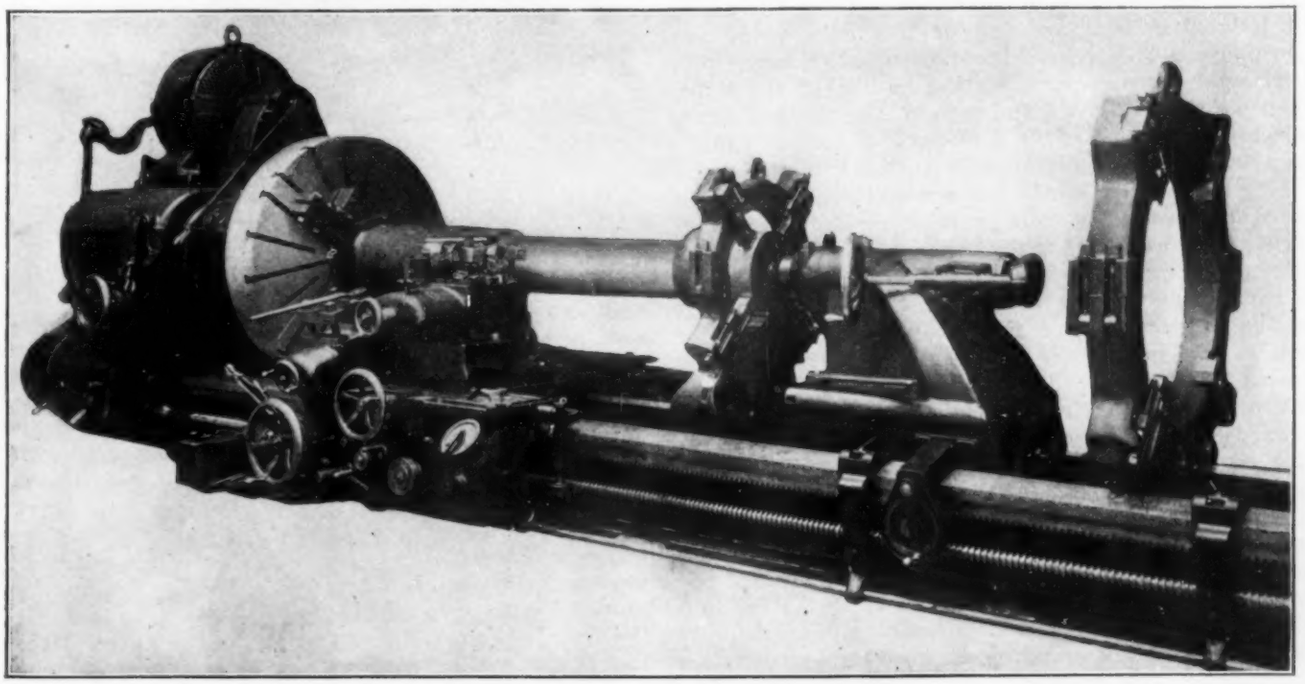


FIG. 1. H. S. & G. TRIPLE-GEARED LATHE

Every lever in this lathe is made of steel casting, as are also the reverse plate and quadrant. The gears are all made of 0.50 carbon steel and nearly all of them are made with the 20-deg. pressure angle stub tooth. Lubrication of the headstock is accomplished by means of a pump mounted at the rear of the lathe where it will be accessible for repairs. In order that the operator may see that the oiling system is functioning properly, an oil gage is mounted on the front of the headstock and an oil indicator in the line from the pump.

The apron is made with front and back walls, which are tongued and grooved through the center in male and female sections, also doweled and bolted together.

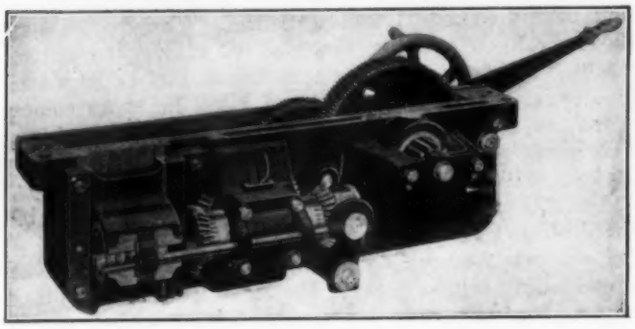


FIG. 2. REAR VIEW OF APRON

This construction precludes the possibility of bearings shifting out of alignment. The back wall is nearly as heavy as the front wall. All gears are made of steel with coarse pitch and wide face. The feed mechanism in the apron is driven by a positive angular tooth clutch, which can be seen in Fig. 2. The construction of this clutch allows the operator to engage or disengage the feeds instantly under heavy cuts. This view also shows the interlocking mechanism between the half nuts for screw and bevel feed gears. The rack pinion and rack are of high-carbon steel, heat-treated, and have stub teeth with a 20-deg. pressure angle.

At the right-hand side of the apron can be seen the motor controller bracket and dial by which the starting, stopping and reversing of the main motor are controlled. The action is transmitted through the horizontal shaft shown near the bottom of the lathe, thence through a chain and sprockets to the controller, which is at the back of the lathe out of the way. Adjusting studs are provided to eliminate slack in the chain.

The long ratchet at the left end of the apron is used when it is desired to exert great power on hand adjustment of the carriage, or for the purpose of feeding the carriage along the bed under heavy cuts. A tool rest for full swing work is mounted on the apron at the left of the carriage, as are also the rapid traverse motor and controller. Power traverse can be obtained by means of the lever directly back of the handwheel, which engages the friction clutch. Moving this lever toward the operator engages the positive clutch, allowing the carriage to be traversed by hand.

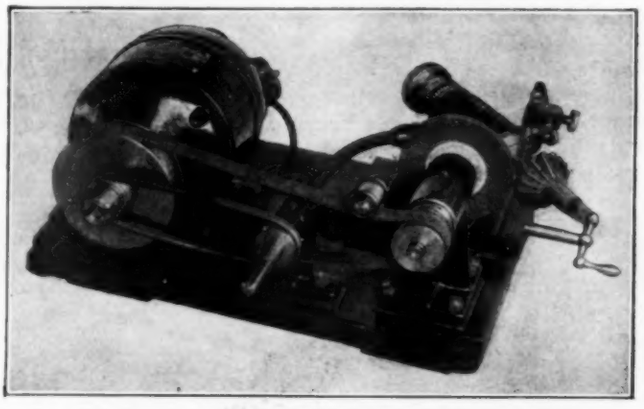
At the extreme right of the illustration can be seen a recently patented support for the lead screw and controller rod. One of the chief advantages of this support is that it can be removed from the lathe in a few seconds and replaced at any position along the bed in a similar length of time. This advantage is particularly in evidence when it is desired to move the support from one side of the tailstock bracket to the other side. Weight, complete on skids, 80,000 pounds.

Franklin Portable Repair-Shop Grinding Machine

The Franklin Machine and Tool Co., Springfield, Mass., has recently placed on the market a portable grinding machine for general use in automobile repair plants. The machine is known as the Model "B" repair-shop unit, and is intended chiefly for grinding valves, sharpening reseating cutters and reamers, and for driving wheels, wire brushes or drills on the end of a flexible shaft.

It consists of a flat base, on which is mounted a ¼-hp. motor, a grinding wheel running in bronze bearings and driven by a belt from the motor, an idler being provided to keep the proper belt tension. A compound slide, operated by means of screws and ball cranks, carries a swiveled head fitted with draw-in chucks for holding the valve or the cutter pilots. The slides are scraped and fitted with adjustable gibs in order to provide adjustment for wear. The spindle in the head is driven by means of a worm and worm wheel through a round belt and a flexible shaft from the motor, so that the position of the head can be changed without interfering with the driving mechanism.

In the illustration, a double-ended valve-reseating tool is shown in position for grinding, this tool being used for machining the valve seats on the cylinder castings. A spring stop is provided in order to properly index the tool. The valve itself can be mounted in the same head for grinding, and since it is not necessary to change the position of the head, the same angularity can be obtained on the valve and on its seat. It is stated that valves can be very quickly ground, and that



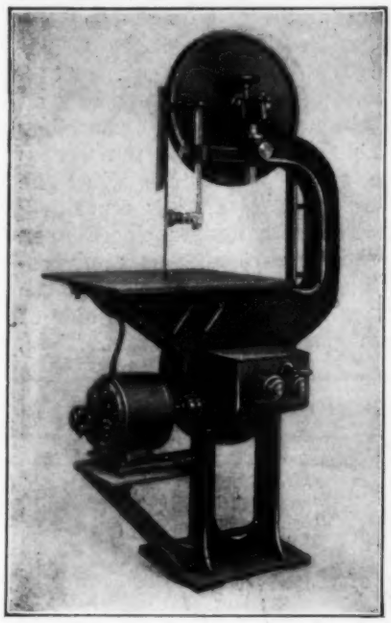
FRANKLIN MODEL "B" PORTABLE REPAIR-SHOP GRINDING MACHINE

they fit so closely that only a small amount of grinding with compound, with the valve in place on the seat, need be done afterwards.

The machine can be adapted to other uses. Attachments or adaptors may be fitted to the end of the spindle for holding breaker arms while regrinding. A wheel-dressing attachment is also furnished. When used with a flexible shaft directly connected to the end of the motor shaft, different types of tools can be driven. Either small grinding wheels or wire brushes can be used on the end of the shaft, or an attachment for holding drills can be furnished. This attachment is provided with a handle having a pistol grip, so that the drill can be easily held and guided. Because of the fact that the whole machine may be easily moved from one place to another, it has a very wide range of adaptability.

Clark Metal Cutting Bandsaw

The illustration shows the metal-cutting bandsaw which has been placed on the market by the Clark Machine Works, Belmont, N. Y. This machine was built to meet demand for a compact sprue-cutting saw for use in brass foundries and shops having to cut brass, bronze, aluminum or any of the softer metals which can be fed up to the saw by hand. The machine is ball bearing throughout, the bearings being so designed that they require no oiling. The upper wheel bearing is packed in grease and is said to run for months without any attention. All other bearings are lubricated from the gear-box. The drive is direct through a worm gear running in a special lubricant, the motor being controlled by a snap switch conveniently located on the under side of the table. It has a sliding-gear speed change operated by a handle on the outside of the gear-box, all gears running in an oil bath.

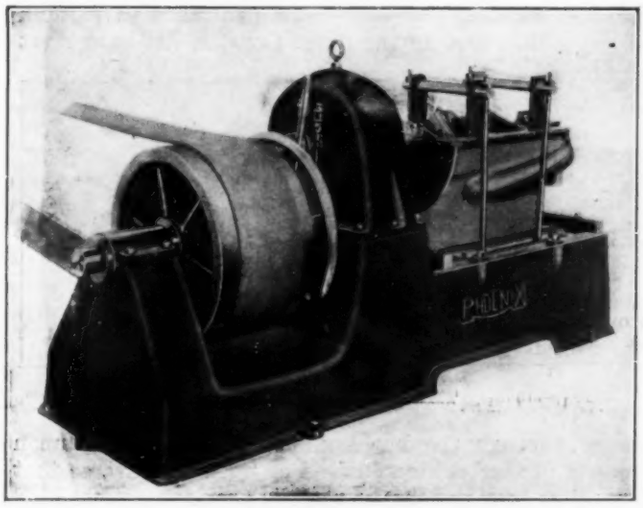


CLARK METAL CUTTING BAND SAW

The wheels are of web construction provided with a flange on the front side which obviates the necessity of wheel guards. It is said that the machine cannot get out of order and will operate successfully with practically no attention.

Phoenix Burning-in and Running-in Machine

The machine shown in the illustration is a combination running-in and burning-in machine which has been placed on the market by the Phœnix Manufacturing Co., Eau Claire, Wis. This machine was designed to burn-in and run-in the main bearings on all makes of motor cars, trucks and tractors. The power is transmitted through a three-to-one gear reduction. The burning-in operation is done at a speed of 200 r.p.m., and the running-in at 600 r.p.m. The machine can be operated from either side. An especial feature is the solid Fibroid cone self-adjusting clutch, said to be especially adapted to the severe strains existing during the burning-in operations.



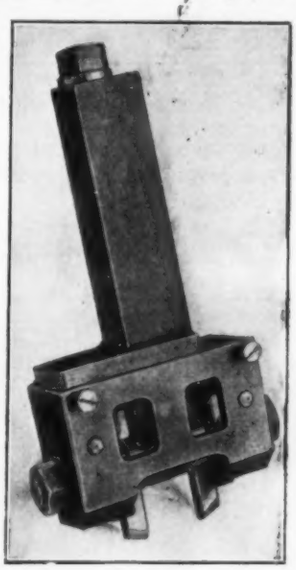
PHOENIX BURNING-IN AND RUNNING-IN MACHINE

The machine is of heavy construction, being ribbed and reinforced. Ford and Fordson fixtures are furnished and other fixtures for different types of motors can be supplied. The machine weighs 2,200 lb. Height, 34½ in. Floor space occupied, 29 in. x 78 in.

Dusenbury Duplex Planing Tool

A planing tool that cuts in either direction, thus making it possible to take advantage of the ordinary idle stroke of a planer table, is being manufactured by the Waltham Machine Works, Waltham, Mass., under the name of the Dusenbury duplex planing tool.

The cage, seen at the lower part of the tool in the illustration, swivels upon the long bolt which passes lengthwise through the shank, and can be clamped in any desired position by the nut at the upper end of the latter. The amount of the swivelling movement can be regulated and adjusted by means of four small screws. Within the cage are two "clapper blocks," similar in principle to the corresponding part of a planer, so mounted as to swing toward each other, thus bringing the two cutting points fairly close together and avoiding the necessity for a long overrun at the end of each table stroke.



DUSENBURY DUPLEX PLANING TOOL

The studs that hold the tools pass through the swinging blocks and are drawn up by easily accessible nuts on the outside. Standard high-speed-steel toolbits are used. The tool may be used in any position, being intended for surfacing, for planing down the side, or for undercutting at an angle. The swiveling feature enables the operator to divide the amount of cut equally between the two cutting points, one for roughing and the other for finishing.

The clapper block of the planer is held down by a taper pin through the lower part of the block and box; or, if it is not desirable to make this slight alteration, a device for accomplishing the same purpose without the necessity for making an addition to the planer will be furnished by the maker of the tool.

Where the duplex tool is to be used continuously upon one planer, it is advisable to so change the pulleys upon the countershaft as to secure equal cutting speed in either direction; but this is not a necessity, as the work may be divided between the tools by swivelling the cage to throw the heavier cut upon the tool operating on the slower speed. All parts of the tool are case-hardened and accurately fitted, so as to be interchangeable between different tools.

The Knebel Self-Tightening Drill Chuck

A drill chuck that is somewhat different in principle from the standard construction has been patented by the Knebel Manufacturing Co. of Middletown, Conn.,

In Fig. 1 may be seen the three principal parts before assembling. A spider, mounted on ball bearings, turns

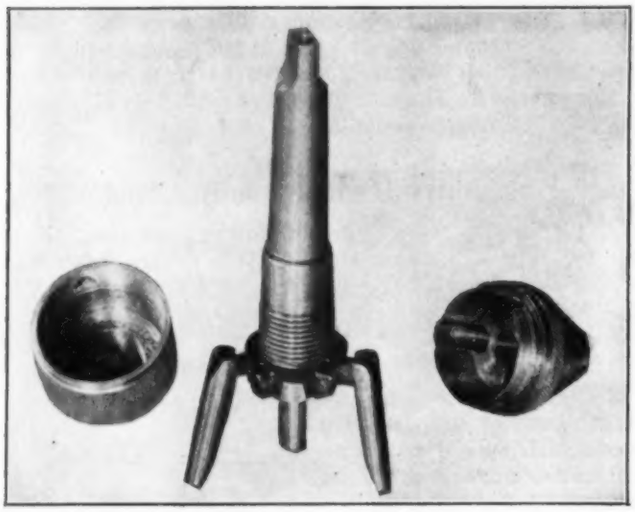


FIG. 1. THE KNEBEL CHUCK DISASSEMBLED

freely upon the central portion of the chuck, and the three jaws are attached to this spider by means of toggle joints.

The shell is in two parts, the upper part, seen at the left in the picture, being threaded to the central part or hub, by a substantial square thread, by means of which the chuck is tightened on a drill. The lower part of the shell is screwed to the upper part by a fine pitch V thread.

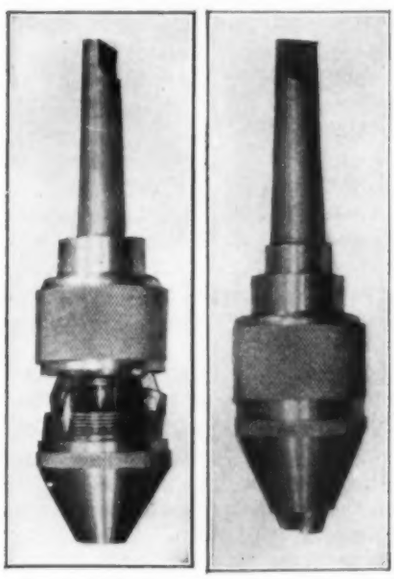


FIG. 2. SHOWING THE SHELL DRAWN APART TO EXPOSE THE TOGGLES.
FIG. 3. THE KNEBEL CHUCK ASSEMBLED

The three holes for the jaws in the lower parts of the shell are round, and by reason of their angular position with reference to the axis of the chuck they cause the jaws to close in as the shell is turned back on the large square thread. Due to its construction, long life for the wearing parts and high gripping power is claimed for this chuck.

In Fig. 2 the chuck is shown with the lower part of the shell unscrewed and drawn forward to expose the toggles. In Fig. 3 may be seen the completely assembled chuck. The chuck may readily be taken apart for cleaning, and there are no loose parts to be mislaid or to be wrongly re-assembled. The chuck is now made in two sizes: To hold 0 to $\frac{3}{8}$ in. and 0 to $\frac{1}{2}$ in.

Marburg "All-in-One" Steel Figure Stamp

Marburg Brothers, Inc., 90 West St., New York, N. Y., has recently placed on the market the "All-in-One" steel figure, or numbering set, for stamping figures on metals. The device, as shown by the accompanying illustration, contains all ten steel figures on the periphery of a steel disk, the figures being hand cut.

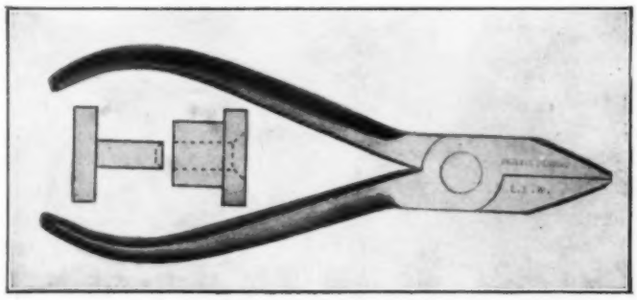
It is said to be easy to align the figures properly on the work being stamped, because of the fact that they are held on a disk. The arrangement of the figures enables the operator to stamp any figure which he desires without the necessity of picking it separately from a box, as is necessary with figures placed upon individual bars. The proper figure may be easily selected without looking at the cut figure itself, because of the fact that the figures are stamped on the side of the disk, both next to and opposite the cut figures. Thus,

MARBURG "ALL-IN-ONE" STEEL FIGURE STAMP

that figure will be stamped on the work which is shown at the top of the disk when in use, or next to the point where the hammer strikes. It is claimed that, besides enabling the operator to do better stamping work, much time may be saved by the use of the device.

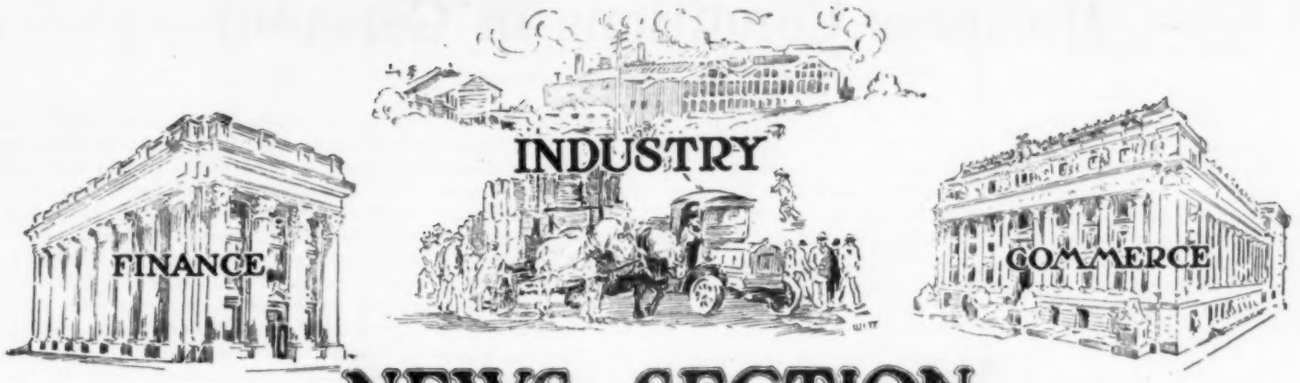
Lindquist Plier

The Lindquist Engineering Works, Portland, Conn., is marketing a plier in which the joint is somewhat different from the usual construction. Instead of using a single rivet to hold the two parts of the plier together the rivet passes through a shouldered bushing. One plier-jaw is counterbored to receive the head of the bushing, which is just long enough to reach the bottom of the counterbore in the other jaw. A flat-head rivet



THE LINDQUIST PLIER

passes through the bushing, taking its bearing upon the end of the bushing instead of upon the jaw, so that no matter how tightly the rivet is drawn it cannot bind the jaws and cause them to stick. The method of construction is shown in the sketch.



NEWS SECTION

Westinghouse Earnings Total Nearly $160,000,000

The gross earnings of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., from sales billed for the year ending March 31, 1921, were, as shown by the company's annual report, $150,980,000, which is an increase of $15,000,000 over the gross earnings of the previous year. The manufacturing and selling cost was $138,774,000; and the net income available for dividends was $12,618,000, or 16.8 per cent on the company's capital stock. Dividends at the rate of 8 per cent per annum were paid during the year on both the preferred and common shares of stock.

There is included in the cost, $5,315,000 for depreciation and adjustment of inventories, which were valued as of Dec. 31, 1920, at cost or market value, whichever was lower. An appropriation of $5,000,000 from surplus for a special contingent reserve has also been made to provide for further possible shrinkages and adjustments in the inventories.

The property and plant account shows an increase over the previous year of $9,361,000. The amount of unfilled orders on hand April 1, 1921 was $65,621,000.

French Duties on Ball Bearings

The *Journal Officiel* for April 3, 1921, contained a decree, dated April 1, which provided for a change in the French duty on balls for ball bearings and ball races, dutiable under item 633sept of the customs tariff. The new rates are 70 per cent ad valorem under the general tariff and 35 per cent under the minimum. The duty on balls for ball bearings was formerly from 66⅔ to 486 francs per 100 kilos, general rate, and from 45 to 324 francs per 100 kilos, according to the diameter of the balls. Ball races were classified as parts of cycles, parts of vehicles or machines or nickeled wares, whichever yielded the highest duty. Ball bearings of American origin are duitable under the general tariff. Goods proved to have been shipped direct to France prior to the publication of the decree may be admitted at the rate of duty formerly in force.

F. A. E. S. Sponsors National Public Works Department

In the consideration of the questions involved in the establishment of the Department of Public Welfare, L. W. Wallace, executive secretary of the Federated American Engineering Societies, has asked the Senate Committee now conducting hearings on that subject, to keep in mind the desirability of changing the name of the Interior Department to "The Department of Public Works" and grouping in it all of the engineering bureaus. The Federated American Engineering Societies represents about 150,000 engineers, technologists, architects and contractors. A portion of Mr. Wallace's presentation on the subject is as follows:

"The constituents of the Federated American Engineering Societies, being engineers and industrial executives have with some concern considered the very illogical and ineffective form of organization that the Federal Government has grown into. Being students of organization methods and procedure, as well as experienced practitioners in the same, they have advocated the establishment of a Department of Public Works, to supercede the Department of the Interior, and which Department of Public Works there would be centered all the major engineering, construction and research work of the Federal Government. In order that this might be done easily it would be necessary to place those bureaus that are not of an engineering, construction or research character that are now in the Department of the Interior, in other departments of the Government.

"The provisions of the bill for the Department of Public Welfare which is under consideration at this hearing provides for a number of such bureaus and activities. The purpose of our appearance is to point out this condition and to urge that the bill be so modified as to properly assign those bureaus that would not be included in the proposed Department of Welfare.

By so doing a material advance would have been made toward a redistribution of governmental bureaus and functions, which is so essentially necessary for the accomplishment of greater economy and despatch in the transaction of governmental business."

Hoover Gets $500,000 for Exports and Bureau of Standards

Quite contrary to the usual practice, the Committee on Appropriations of the House of Representatives acceded to the request of the Secretary of Commerce and allowed the full $250,000 requested for export industries. This fund is to be used principally in an effort to assist the twelve chief export industries, to wit: Cotton and cotton goods, paper and paper products, leather and leather products, chemicals (including dyestuffs), heavy machinery and machine tools, electrical goods, automobiles and accessories, lumber and lumber products, jewelry and silver, metal products, vegetable oils, and hardware.

In addition, the Committee approved the full amounts which Secretary Hoover asked for the Bureau of Standards, as follows: Testing structural materials, $50,000; industrial research, including elimination of waste, $100,000; standardization of equipment, $100,000.

These items are included in the second deficiency appropriation bill, which was reported to the House by the committee on May 18.

Destructive Fire at American Car and Foundry Shops

Fire which started when "spatter" from molten iron flew across the blacksmith and machine shops of the American Car and Foundry Co., at Terre Haute, Ind., on May 19, destroyed the two shops comprising about half of the entire plant and caused damage estimated from $100,000 to $200,000. The walls of the two shops, which were housed in a section of the plant about 150 ft. long, were all that were left standing. Expensive machinery and tools were ruined, and salvage of the metal will be the only saving from the fire. The fire was the second heavy loss suffered by the company during the last two years. In the fall of 1919 fire destroyed the west section of the plant, which later was rebuilt. Between twenty-five and thirty men will be out of work as a result of the fire, it was said by Joseph E. Parson, foreman of the blacksmith shop.

Business Conditions in Germany

By Our Berlin Correspondent

Berlin, May 2, 1921.

Germany has now entered into a phase which probably is one of the most critical in her history. No matter whether the present crisis develops into an acceptance of the imposed reparation conditions, or, what seems improbable, ends in their refusal, with an inevitable economical war following, she will find herself in an entirely new and most serious position. The momentous decision which the country has to face at present is largely an industrial problem, a foremost consideration being the question how far the industry in the interior of the country could continue its existence, in the case of losing control over the Ruhr district, after the economical detachment of the Rhineland and under the other effects of the sanctions.

The Government is, therefore, strongly leaning upon the advice of the country's industrial leaders, and no effort is spared on their side to influence the ultimate decision. The attitude of those circles is a peculiar one, considering that their own interests are primarily at stake. Your correspondent has lately interviewed several industrials of high standing. Their opinions are mostly of a sentimental nature. They entirely lack clear foresight and the only impression that can be gained from what they say is that the German industry as a body stands for refusing the imposed reparations, and for facing all the consequences. Whether or not this policy will be adopted by the Government, which is hardly likely, will be decided long before these lines come before your readers, but the attitude of the industry largely responsible for bringing the problem to this pass will no doubt be worth recording in any case. The opinions heard by your correspondent from industrial leaders vary so little that it is sufficient to quote one, that of Dr. Waldschmidt, president of Ludwig Loewe & Co., Aktiengesellschaft, a personage of influence in the engineering industry of the country.

Dr. Waldschmidt, when giving vent to his opinion that the London ultimatum should be refused point-blank, said that while the industry was well aware that the period ensuing would be fraught with distress and hardships, they would be the lesser evil. In his opinion—which coincides with that of most industrials—these hardships must be braved, trusting to the future and to the course of political and economical developments to set matters right. Even taking, he maintained, the worst aspect of the threatened occupation of the Ruhr district, and all the pressure which has been or still might be brought to bear on Germany, the industrial life in the interior could never be entirely suppressed. The greatest difficulty of course would be the loss of control over the coal supply, but considering the world's coal situation, no market could be found for the coal now consumed by Germany, and the worst that could happen, he says, is that the price of Ruhr coal for German consumption would rise to the world market standard, which does not differ now so greatly from domestic prices.

The Iron Supply

The same, he believes, would apply to the iron supply. As long as Germany can maintain her comparatively cheap and highly efficient labor, he believes that use for it will be found under any conditions, seeing how much the world stands in need of it. Of course he quite recognizes that industry and trade would suffer severely. He and his brethren, however, seem to be firm in their belief that such conditions could not last very long, and that the forces at work in the whole world to restore economical balance would in the course of time interfere in Germany's favor.

With regard to the question of accepting the London ultimatum, his mind is quite made up. Such acceptance would according to his idea be quite suicidal, as the tribute it would impose upon Germany is, he says, entirely beyond her economical strength. Instead of creating a basis of economical reconstruction, he believes that Germany's inability to fulfil her obligations would continuously call forth measures of reprisal, and perpetuate the atmosphere of unrest in Europe. This opinion is shared by the majority of German industrials, and as the financial obligations which Germany would have to take upon herself are largely based upon her industrial productivity, this carries great weight with the government and the general public. It is of course of a purely sentimental nature, no one in Germany being able to clearly recognize the limit of her present financial strength, or being equipped with sufficient foresight to estimate what the country might perform in the future.

To increase the present standard of industrial productivity is in Dr. Waldschmidt's opinion impossible, as he is convinced that the workmen have reached the maximum of efficiency which can be expected of them in their present physical condition. An improvement in the latter respect, he says, is out of the question, as the country will be impoverished further in any case, and consequently the standard of living will sink instead of gradually rising. Dr. Waldschmidt sees no possibility of increasing the productivity by specialization and by better organization of work, without further taxing the workmen's strength.

An Optimistic View

More optimistic in the latter respect is the view taken by Dr. Walter Rathenau, president of the A. E. G. Electric Company. His opinion is noteworthy insofar as it represents the first voice expressing with authority the belief that German production is still far from the acme of efficiency, and that there is a wide and hopeful road still to be traversed toward this goal. It is also a singular fact that Dr. Rathenau has been most firm in quite different views until not long ago, and that, therefore, his judgment has undergone a rather marked change. German methods of production, he says, are far from perfection, and the output of the industry is hardly commensurate with the efforts made for it. The German production is at present based on 32 billion working hours. By accepting the ultimatum, he asserts, each working hour would be taxed with two paper marks toward paying the country's obligations. To do this, and still go on producing at a reasonable margin of profit, can only be performed by eliminating every possible waste of time, labor and material. A complete transformation would have to take place if this aim is to be achieved, which would be the more difficult as, he observes, the public spirit and mental elasticity in Germany are perceptibly on the down grade. Rathenau, too, advocates the refusal of the ultimatum, but he evidently has not lost sight of the other alternative. His views on industrial productivity quoted above represent now the most advanced state of mind to be found in Germany, and the clearest foresight which may be encountered. The general run of manufacturers is far from accepting them.

Business Conditions

Business conditions are slowly but visibly depreciating. The opinions previously expressed in these columns, that a further aggravation of the business situation must be expected, are confirmed in a report recently made to the Ministry of Commerce, by the chambers of commerce of the country. From this report it becomes evident that the depression is deepening and spreading, and that its pinch is making itself felt everywhere more and more strongly. The number of unemployed gives little indication of such state of affairs, but it must be considered that in March and April a large decrease of unemployment as a rule takes place, due to the fact that the building and other open-air trades absorb unemployed from other trades. Taken absolutely, no material change is noticeable in the number of unemployed, but at the present season this amounts to an increase.

The critical conditions are more readily recognized by the fact that the number of shops reported to be "insufficiently employed," meaning very badly, has increased from March to April by 5 per cent.

Under such conditions it is rather surprising to note that, judged by the formation of new companies, and the

issue of fresh capital, industrial enterprise not only continues, but has from March to April even made further progress. Not less than 64 new stock companies have been formed in April, compared with 44 in March, with a total capital of 494 million marks. Twenty-four of this number represent the incorporation of existing concerns, while 40 are new organizations. Of this number 17, or 25 per cent, fall to the share of the machine-building industry. Thirty-five machine-building concerns out of a total of 141 have increased their capital. Industrial investments of the industry during the first four months of the year were as follows:

January	2,042,220,000 m
February	2,397,290,000 m
March	893,620,000 m
April	2,558,840,000 m

It appears that investments in April exceed any of the previous months, although it must be considered that large capital transactions in the chemical industry, which in the above data are represented by some 800,000,000 m, have inflated the April returns.

Business across the new customs frontier is still at the lowest possible point. It is further minimized by shipping difficulties, the frontier stations being clogged with goods transports, owing to the fact that the new customs organizaion is not yet in working order. A large machine-building manufacturer with a branch establishment in the occupied territory, whom your correspondent asked about his experiences made with regard to shipping to and from his Rhenish plant, had to confess that he could not tell, because actually there were no such shipments made yet. Complete regulations for the occupied territory have now been issued, and it has been noted with consternation that the Inter-Allied Rhineland Commission has made shipments from that part to the interior, and vice versa, subject to export and import licenses. In the general opinion this denotes that it is the desire of the Entente countries to detach the Rhineland from the rest of Germany as much as possible, and to put it in close contact with the adjoining Entente countries. This is confirmed by the fact that the frontier between those countries has been opened to a number of products hitherto excluded from import into Germany, and it is feared that such products will find their way into the interior across the Rhine customs barrier. Shipments coming from the occupied territory will, therefore, be strictly controlled on the German side as well, thus adding further to the difficulties of intercommunication.

Prices for Machine Tools

In the machine tool business no material change is noticeable. Manufacturers believe that the lowest point has already been reached. The demand, such as there is, is mostly confined to small types, up to a price of from M10- to, M15,000. Larger sizes and more expensive types have a very limited market. The situation is further aggravated by the number of dealers trying to clear their stocks at a greatly reduced price, often at a sacrifice. Originating from this source, price cutting is becoming the rule, especially among dealers. Only large factories of high standing staunchly keep up prices. No large specifications have come into the market, orders placed being mostly for single pieces, and after considerable haggling.

The second-hand trade is also making itself felt more severely, although it is now more or less in the hands of several potent organizations, able to preserve a certain balance in the market. Still, an increased pressure from this side is making itself felt, and numerous orders are going into the hands of the second-hand trade, which otherwise might have benefitted the manufacturer.

A sore spot in this respect is the clearing of the surplus stock of the government ordnance and ammunition works, still comprising approximately from 5- to 6,000 tools of various sizes and types. This stock has been placed, at ridiculously low prices, in the hands of one firm of second-hand dealers, which before the war occupied a modest position, and which now is one of the largest organizations of machine tool dealers in Germany. The name of this firm, J. Neuhöfer, and its enterprising chief partner, Kahn, have in connection with this contract been giving cause for many heated comments in public. So far this government stock has been wisely withheld from precipitous marketing, but it is now flooding the market in a dangerous degree.

The only good point of the situation is the reduction of iron prices, and in connection with it the decontrol of semi-finished material, but the relief afforded thereby is largely counteracted by the increased freight-rates. The coal supply, after the improvement of the last months, has again taken a more serious aspect, in connection with the political troubles in Silesia, and as a consequence of the discontinuation of the overtime shifts in the Ruhr district, which must now be considered as permanent. Most characteristic of the hopeless tone prevailing in the machine tool industry is the fact that many industries have reduced their selling organizations. Retrenchment is adopted as the safest policy everywhere.

Enterprise Lacking

Noticeably absent in the present business calmness is enterprise with regard to improved or new designs. With the exception of a few small specialties, nothing novel has been put on the market for more than six months. A number of machine tool builders are keeping up employment by contract work for manufacturers in other lines, mainly for railroad material. Even a firm of the standing of Loewe's is to a large degree employed by work of this kind for the affiliated Knorr-Bremse Aktiengesellschaft, a company making railroad brakes. On the authority of Dr. Waldschmidt, the president of Loewe's, the employment of the machine tool industry is at present approximately 25 per cent of normal.

Somewhat better conditions prevail with the small tool industry, which is not so overrun by competition, and which no doubt is profiting by the deteriorated quality of the tools, due to inferior steel used, resulting in rapid wear.

New Steamship Line to Near East

The steamship "Gul-Djemal," which sailed from New York on May 25, inaugurated a direct passenger and mail service with Constantinople. Heretofore there has been no direct passenger or mail service between the United States and Constantinople. With the opening of this service the United States will be placed in direct communication with the rich countries of the Near East. The sailing of this steamship with a full cargo and flying the pennants of the Interallied Commission and the United States Mail Service marks an epoch in the development of trade between the United States and the Near East.

The territory which is reached through Constantinople is one of the richest in the world in resources and commerce. It is a territory from which the United States imports annually many million dollars worth of products and in which American merchants and manufacturers may find a market for many million dollars worth of their products, foodstuffs and manufactured goods. The countries included are Turkey, Greece, Rumania, Bulgaria, Syria, southern Russia, the Black Sea District and other parts of the Near East.

Weingar to Address Engineering Bodies

W. H. Weingar, representing the Pratt & Whitney Co., of Hartford, Conn., will speak before an open meeting of the American Society of Mechanical Inspectors to be held in the Hotel Sherman, Chicago, on June 7. The subject will be "Manufacturing and Measuring in Millionths of an Inch." Superintendents, inspectors and others interested in close interchangeable manufacture are invited.

On June 6 Mr. Weingar will deliver the same address before the Western Engineering Societies, at Rockford, Ill.

A Correction

John W. Anderson, of Rock Island, advises us that our article on page 848 describing the new self-propelled gun mount built by the Holt Manufacturing Co., of Stockton, Cal., does not give proper credit for the design and building of the various parts. The gun itself was made at the Watervliet Arsenal and the mount and recuperator at the Rock Island Arsenal. We are pleased to make these corrections so that deserved credit may be given to the various parties concerned.

Summer Meeting of Society of Automotive Engineers Held at West Baden, Indiana

The weather man did his best to make the Summer Meeting of the Society of Automotive Engineers a seasonal affair, and he succeeded. The members arrived by special train and by automobile at West Baden Springs Hotel, on May 24, to find the mercury reaching for the top of the thermometer. The inside of the hotel was the coolest place in sight and the afternoon session of the Standards Committee, which opened the convention, was well attended.

Reports were made by the following divisions: Ball and Roller Bearings, Electrical Equipment, Parts and Fittings, Stationary Engines, Isolated Electric Lighting Plant, Screw Threads, Chain, Engine, Lighting and Truck. Chairman B. B. Bachman, vice-president, representing motor car engineering, presided and directed the rather warm discussion that arose over several disputed points. Of most interest to shop men was the extension of the standard specifications for roller chain sprockets as presented by the Chain Division and approved by the committee. This report will be published in a later issue.

The Sections Committee held a meeting at three o'clock at the call of the chairman, H. R. Corse, and the sports program got under way at the same hour with preliminary contests in golf, tennis, baseball and trap shooting. The semi-annual business meeting was held in the evening, at which were presented the president's address and the reports of the treasurer and the committees on standards, membership, sections and meetings. The members of the nomination committee were elected at this meeting. The business meeting was followed by moving pictures and informal dancing.

On Wednesday morning the session was devoted to Aeronautics, with Howard E. Coffin as chairman. The tournaments in golf, tennis, croquet, clock-golf and cards for the ladies were begun at the same time. The afternoon was devoted to inter-sectional baseball and the continuation of the various tournaments.

Wednesday evening was designated as Indiana night and the speaker of the evening was Mr. Lieber, State Conservation Commissioner. A burlesque lecture on a technical subject was delivered by Mark Smith, of the Indiana Section. Mr. Smith was introduced as Captain Morini of the Royal Italian Engineers. He was dressed for the part and carried the hoax through in real professional style.

A general research session was held on Thursday morning with papers on Industrial Research, by L. A. Hawkins; Lubrication, by C. W. Stratford; Clutches, by Herbert Chase; and Co-operation in Research, by W. E. Lay. An added session on Highway Transport was held later, with H. W. Alden as chairman.

The S. A. E. field day occupied everybody on Thursday afternoon, when all kinds of athletic events were contested by men, boys—and even the ladies. Some disappointment was expressed at the lack of facilities for water sports which have been a big feature of previous meetings.

On Thursday evening the entertainment consisted of a lecture by Stephen S. Johnson on Little Zion Canyon, a Rainbow of the Desert.

The session on Friday morning was devoted to combustion with Thomas Midgely, Jr., in the chair. Papers on Turbulence in Theory and Practice, by H. L. Horning, and on Flame by C. A. French, were presented. An abstract of Sir Dugal Clerk's paper on Cylinder Actions in Gas and Petrol Engines, was read by Daniel Roesch.

The afternoon saw the wind-up of the athletic competitions and the evening the grand ball and awarding of prizes.

The last session, which was held on Saturday morning, was devoted to Fuel Research, and was presided over by O. C. Berry. The papers were: Development of a High Compression Oil Engine, by F. E. Ziesenheim; Manifold Development, by G. P. Dorris; and Elements of Automobile Fuel Economy, by W. S. James.

Detroit Engineers Elect Officers

At the annual dinner of the Detroit Engineering Society, held in that city on April 29, the officers for the new year were announced.

M. W. Taber was elected president; J. R. McColl, first vice-president; A. L. Trout, second vice-president, and O. H. Dawson, secretary-treasurer.

The Detroit society is preparing to take an active part in the regional meetings of the American Society of Mechanical Engineers, to be held in Cleveland on June 13 and 14.

Meeting of Screw Thread Commission

The National Screw Thread Commission met at the Bureau of Standards, Washington, D. C., on April 18, and considered the progress report recently issued, and outlined a program for continuing the work of the commission.

The following program was agreed upon and will be carried out under the direction of sub-committees: (1) Specifications and tolerances for taps, dies, and tap drills; (2) standardization of bar stock for producing cut and rolled threads; (3) standardization of bolt heads, screw heads, and nuts; (4) standardization of instrument thread and threads cut on brass tubing; (5) standardization of acme, square, buttress, and other special threads, and (6) tolerances and allowances for Class IV, wrench fit.

The progress report is also to be further studied with a view to incorporating in it more information as to the specific class of fit and series of thread pitches to be used under different conditions.

Strict Retrenchment of Expenditures Advocated by Academy of Political Science

Featuring its one-day conference with a luncheon, at which President Harding was the guest of honor, the Academy of Political Science in New York held one of its most successful sessions on Monday, May 23, at Hotel Astor, New York City. Government reorganization with the object of financial retrenchment as the goal, was the whole sense of the meeting.

President Harding at the luncheon, discussed the subject "Business in Government and the Problem of Governmental Reorganization for Greater Efficiency." He made a plea for clean politics and showed his regard for the great power of popular opinion when he said—"No popular government will ever survive where the men who make it, fail to take an active and intelligent part in its administration." He decried governmental interference in business, but said that the principles of private business should be applied to government business.

The first session of the conference was opened with an address by Herbert D. Brown, chief of the U. S. Bureau of Efficiency, who argued for a reduction of armaments, saying that 88 per cent of our national expenditures were spent for military and naval establishments; reducing these would reduce taxes.

John T. Pratt, chairman of the National Budget Committee, spoke on the proposed budget system which is expected to be introduced into our national government system. He said that the present system is not the result of intelligent planning, but of piece-meal building and that re-grouping is necessary.

Ex-President William Howard Taft said that if we had had a budget system years ago, we would not have spent so much money on the late war. He lent approval to the suggestion of having the cabinet officers go before Congress and discuss their plans.

At the second session Edgar B. Davis, engineer, of New York, said that if the nations of the world had agreed on disarmament, six billions of dollars would have been saved last year. George D. Strayer of Columbia University, stressed the ever-growing necessity for education. He made an eloquent appeal for the support of the public schools, saying that knowledge is power, and that learning is a greater force in the perpetuation of world peace than all the programs of diplomatic councils put together.

No National Daylight Saving

It has been decided definitely by the Committees of Congress having jurisdiction over daylight saving bills that the subject is not to be given consideration. This puts an end to the hope that daylight saving might again be made national during the coming summer.

Spring Meeting of the American Society of Mechanical Engineers

Warm weather greeted the many members of the American Society of Mechanical Engineers who attended the spring meeting at the Congress Hotel, in Chicago, from May 23 to 26. This, however, did not interfere with the enjoyment of the members in the program provided and the meeting was very successful in every way. The first open session was the business meeting at which Morris L. Cooke presented his paper on "The Organization of an Engineering Society." Mr. Cooke has always advocated a broad foundation for engineering and a full appreciation by the engineer of his civic responsibility.

This paper was followed by a long discussion on the proposed new constitution of the society in which a number of suggestions was made for the consideration of the committee which is handling the revision. Among them was the proposal to give the vote to junior members.

On the 24th four sessions were held simultaneously, three being under the auspices of separate divisions, Fuel, Machine Shop Practice, and Management, the last in large part devoted to a discussion of Mr. Cooke's paper of the previous day.

The Influence of the Automobile

The papers presented to the Machine-Shop Practice division centered around the influence of the automobile industry on machine tools and machine shop practices. The session was presided over by F. O. Hoagland, and the papers were as follows: "Influence of the Automobile on the Machine Tool Industry in General," by F. A. Hendrickson; "Influence of the Automobile on Gear Cutting and Gear Cutting Machinery," by Henry J. Eberhart; "The Relation of Power Presses and Dies to the Automobile Industry," by Henry A. Hinde; "Influence of the Automobile on Lathe Practice," by Ralph E. Flanders; and "Fundamentals of Interchangeable Manufacture," by C. B. Lord.

Mr. Hendrickson divided the developments in machine-tool building as affected by the automobile industry under the following heads: Materials and Their Proper Distribution; Precision and Specialization; Power; Manipulation; Speed; Lubrication; and Safety Devices. The discussion brought out the statement by J. A. Smith of the General Electric Co. that the lack of proper lubrication was the cause of most machine-tool failures. Hence he advocated better provisions for oiling all bearings and the use of a reservoir when possible. C. B. Lord felt that most machine tools for production work are provided with too many feeds and speeds. Forrest E. Cardullo of the Gray Planer Co. pointed out that as all machine bearings did not require the same kind of lubrication, provision should be made for having machine tools oiled regularly and correctly by men assigned to that duty. He also pointed out that the demand for weight in new tools was not of itself an improvement unless it were properly distributed and that after sufficient weight had been put into a machine any additions simply increased the expense unnecessarily.

Gearing Not a New Subject

In his paper on "Gear Cutting," Henry J. Eberhart gave a brief sketch of the development of gear tooth forms, showing that great credit belonged to both Sang and Willis as well as to others who preceded them. Lantern slides showed extracts from publications of sixty to eighty years ago, which proved that they thoroughly understood the requirements of perfect gearing and that they designed tooth forms for both high and low pressure angles. They also showed how teeth of these forms could be generated in much the same manner as is done today. The discussion brought out interesting information regarding gearing having from 5- to 30-deg. pressure angles. The lower pressure angles have been found most advantageous in printing press machinery and in automobile timing gears, where quiet running is one of the essentials, and where it is necessary to have a slight variation in the gear centers.

In the paper on "Power Press Practice" many interesting points were brought out and some extremely good examples of cold drawn steel were shown. This paper elicited discussion both as to the work performed and the construction of power presses in general. The main criticism seemed to be that crankshafts usually had more throw than the work demanded and that the housings did not always have sufficient metal. It was further suggested that bearings be made more accessible.

Ralph E. Flanders prepared an elaborate paper showing the effect of the automobile on lathe practice which unfortunately was not received in time to be published for the meeting. The excerpts made by the publication committee could not do justice to the paper itself and as a result the meeting was deprived of much valuable information along this line.

Fooling Ourselves on Interchangeability

In his paper on interchangeable manufacture, C. B. Lord pointed out the many difficulties which always present themselves when interchangeability is attempted. He cited an instance in which 10,000 pieces were secured from each of four well-known manufacturers. The manufacturers themselves proposed the tolerance of 0.0015 in. and yet the pieces in each lot varied as much as 0.014 in. The most interesting point is that even with this variation, they were plenty good enough for the work in hand.

The following extract from Mr. Lord's paper will perhaps give the basis of his argument as clearly as can be done.

"Securing one very accurate dimension on a piece is a comparatively simple matter. The ease of securing two accurate dimensions, however, depends upon the relation of the second to the first. The figures given in the following table are based upon practice and general impressions, but the author believes them accurate enough to justify their publication for the purpose of showing the high cost of unnecessary accuracy:

No. of Dimensions on One Piece	Probable Number of Perfect Pieces	Per Cent Estimated Increase in Ratio of Cost per Operation
1	100	0
2	90	30
3	50	75
4	15	100
5	5	200
6	0	500

"In making the foregoing statements the author has in mind automatic and other machines where the close-dimension work is done at one setting and in manufacturing quantities. Some will dispute the figures given in the table and will declare that it is not good practice to attempt finishing pieces in the automatic, but that they should be roughed out there and finished on a shaving lathe or elsewhere. This brings us to our third fundamental and we may ask, Why should they not be finished complete when a good automatic must, in the nature of things, be (and is) as accurate as a single-purpose machine on a single accurate dimension? It is not accurate on several close ones, however, and accepted practice confirms this statement; and the reason why it is not and cannot be accurate is because of conflicting stresses."

The Management Division

There were presented before the management section papers on graphical methods, by W. E. Marshall and industrial waste, by L. W. Wallace, Executive Secretary of American Engineering Council. The evening session was devoted to the question of Training for the Industry and included three papers: "What the National Metal Trade Is Doing and Intends to Do in Industrial Education," by H. E. Smith; the "Engineering Industries and Education," by D. C. Jackson and M. W. Alexander; and "General Education of the Engineering Profession," by H. E. Miles. This session was of particular interest to those who feel the need of more highly trained mechanics.

The papers presented to the railroad division were: "Advantages of Large Freight Locomotives, Particularly 2-10-2, Type," by Albert F. Stuebing; "The Design of Large Locomotives," by M. H. Haig, and "The Necessity for Improvement in Design and Application of Present Day Locomotives," by H. W. Snyder. The session closed with a business meeting of this division.

What Machinists Are Doing for Disabled Ex-service Men

By J. W. Jefferis

President Harding's appeal to the nation, "unfailingly to express the gratitude of the Republic in a generous and practical way to its defenders in the World War," has been met by a hearty response on the part of the business men of the country, without whose co-operation the rehabilitation of the men who were disabled in service can never adequately be realized.

Thousands of disabled ex-service men are now studying mechanics in the trade schools and other technical institutions of the United States, and thousands more are serving as apprentices in machine shops, under the supervision of the Federal Board for Vocational Education. The present industrial situation renders especially urgent and imperative the closest and most sympathetic co-operation between these trainees, employers and the Government.

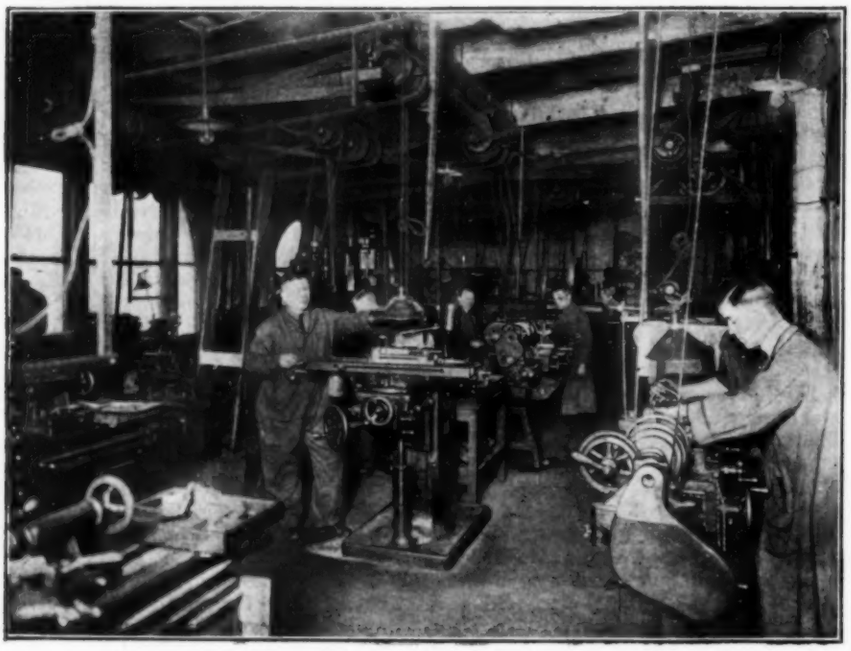
That employers are already earnestly helping to rehabilitate the men who forsook all to serve their country in its hour of need is evidenced by the fact that, in New York City alone, Federal Board trainees are now receiving placement training in seventy shops, including the Brooklyn Navy Yard which offers exceptionally high class instruction.

Complete details regarding the conditions of service and pay will be furnished by the Director of the Federal Board for Vocational Education, Uel W. Lamkin, 200 New Jersey Ave., Washington, D. C. Employing machinists with shops in New York City should address Federal Board for Vocational Education, 370 Seventh Ave., New York.

About half of the men who are selected for work in machine shops have received training in such institutions as Pratt Institute, Lincoln Institute, the College of the City of New York, and the best trade schools of the country. Only one-third of Federal Board trainees are green hands. Not less than 10 per cent of the men were machinists overseas. The majority suffer with disabilities which do not prevent them from working at the trade efficiently.

The retraining of disabled ex-service men is intrusted to the Division of Rehabilitation, in charge of Uel W. Lamkin, director, and R. T. Fisher, assistant director, who administer the duties of their office according to the recommendations of the Federal Board. Besides the central office in Washington, this division has fourteen districts established throughout the United States with staffs totaling about three thousand employees, engaged in the advisement, vocational training, and placement in positions of disabled soldiers, sailors and marines. Of approximately 80,000 men now in training, the cases of about 11,000 are on file in the New York office.

Employing machinists will also be interested to learn that the act of Congress passed June 2, 1920, providing for the training of all persons vocationally handicapped in *industry or otherwise*, numbering about 150,000 a year, will broaden to a notable degree the beneficent work of human salvage undertaken by the Government. This task has been committed to the Federal Board for Vocational Education, co-operating with the various states. Thus America is launched upon a program of uplift, the most significant and stupendous ever undertaken by any country.



DISABLED EX-SERVICE MEN IN TRAINING

Washington Notes

By Paul Wooton
Washington Correspondent

At the close of the Civil War, the United States was the military superior of any country in the world. Fifteen years later, the nation was as helpless as China. At the close of the World War, the United States was stronger from a military standpoint than was any one of the Allies. The problem now facing Congress and the General Staff of the Army is the prevention of another relapse into military impotence. The matter is being given the most active consideration as the debate on the Army Appropriation Bill discloses.

Munitions preparedness is to a very large extent a matter of mechanical preparedness. While the matter of maintaining a proper reserve of ammunition is an important problem, it does not compare in importance with the matter of maintaining a proper reserve of guns, unloaded projectiles and the other mechanical accouterments of war. War material under present day conditions will become obsolete more quickly than ever before has been the case. For example, it has been recommended, since the Armistice, that the ranges of all mobile guns be increased on an average of 50 per cent without material increase in weight. It already has been demonstrated that it is possible to meet that requirement. During the World War, tractor-drawn artillery succeeded animal traction. The advance in this respect has been so great that even now mobile guns of large caliber are being mounted on self-propelled caterpillar gun carriages, which have the speed of trucks on good ground and are able to cross country at nearly any point passable for infantry and at a much greater speed than infantry could move. No nation can afford, men of vision declare, to refuse to develop automotive artillery of the type that will be independent of roads. Roads are good targets and can be rendered impassable so easily that an army would be in a precarious position were it to depend on a transport limited to highways.

Washington is also giving careful study to the matter of industrial mobilization. It is recognized that there is the greatest need to have a plan prepared in advance with which all the necessary industrial establishments will be familiar. The lack of such a plan prior to our entry into the World War led to great confusion and the loss of most valuable time. As a matter of fact, the very first appropriation made by Congress for munitions was ten weeks after the United States had declared war. That amount was small and it was not until six months after war was declared that a substantial appropriation was made available. An intelligent munitions policy, it is held, would prescribe the rates of production required, would provide authority to contract or arrange otherwise for such production, the day war is declared. If an ideal plan were

adopted, each plant would be assigned in advance to manufacture its part of the munitions likely to be required. They would have on hand approved drawings of the articles which had been assigned to them for manufacture. They would know in advance to whom they might look for their raw materials and would know where the product would be shipped.

Such problems as these are even now being laid before the mechanical engineers of the country for their co-operation and support. It is such an important part of the national defense that it is believed Congress will take steps to prevent our present adequate reserve of munitions from becoming obsolete.

The Army bill which is about to be taken up by the Senate, as this is written, contains the following Senate amendment: "The Secretary of War is authorized in his discretion to sell to any foreign state or Government upon such terms as he may deem expedient, any material, supplies or equipment pertaining to the military establishment as, or may hereafter be, found to be surplus, which are not needed for military purposes and for which there is no adequate domestic market."

This provision is intended to relieve domestic manufacturers from the uncertainties which overtook their markets as a result of the efforts of the War Department to force all the surplus material on the domestic user.

The Army bill carries an appropriation of $19,200,000 for the Air Service. Among other things this appropriation was made available for the purchase of tools, machinery, repair shops and the operation and equipment of machine shops. The bill directs the Secretary of War to sell 10,000 motor trucks and 2,000 passenger carrying automobiles. The appropriation from which purchases of tools is made totals $2,900,000. The greater portion of that fund, however, must be expended for the many items making up the current expenses of the ordnance service. The sum of $150,000 is made available in part for the manufacture, test and maintenance of sighting devices for airplane bombs and devices for carrying and releasing such bombs.

The War Department has called for bids for 22,000 tons of shell steel, in the form of shell and shell forgings. The bids are to be opened June 6.

In 1869 the trustees of Stevens Institute of Technology were compelled by the collector of internal revenue to pay a collateral inheritance tax of $45,750, which was assessed upon the bequest of Edwin A. Stevens. It was not the intention of Congress to levy a tax on a bequest to an educational institution, as was demonstrated by the prompt amendment of the law under which the tax was collected. The trustees of the institution, however, have been trying unsuccessfully ever since to recover the amount paid. Until recently they have been contending for the principal and interest but only the tax was refunded.

Machine Tools at the Basle Fair, in Switzerland

SPECIAL CORRESPONDENCE

Supported by a confederation subsidy of 20,000 francs, the annual fair, the fifth of the series, was duly held in Basle, ending on April 26. Confined to Swiss products, it naturally included some examples of engineering, but was not by any means representative of that section of Swiss activities. And though machine tools certainly occupied their fair proportion of the 1,000 stands forming the total, yet they were not nearly so numerous as on the occasion of the last fair. The exhibits were not particularly outstanding, but mention may be made of the Zehnder universal tool and cutter grinder, with electric drive by two small motors, one by belt up the center of the column for the wheel, and also by belt on extended spindle of the same motor to a gearbox and then by flexible shaft and worm to the workhead, the other motor being for the longitudinal movement of the worktable. Generally speaking, in its mechanical features the machine is on a well-known model. Zehnder & Sons also exhibited magnetic chucks for direct current and for alternating current, the only chucks for that purpose being made in Europe. At Gränichen the firm is organizing two independent factories, one for each of their products. Grinding machines of one form or another were certainly a feature of the fair, including the Häberli tool grinder, the Studer universal machines, the Wunderli universal grinder, also intended for cutters, etc., and a small surface grinder by the same firm, with automatic reverse to the transverse movement. Machines of the Linisher type, that is, with emery band running on two horizontal pulleys, seem to have received rather unusual development by the Schweizerische Schmirgel & Schleif Industrie, the types including the ordinary band grinders of this type having the operative surface running horizontal a type in which it is vertical, the belt then running over two pulleys on horizontal spindles placed in line one above the other, and also a type in which the belt presents a vertical working face but runs horizontally, that is, is driven by two pulleys, one at each end on a vertical axis.

A machine apparently prepared specially for the exhibition, the design of which, it is admitted, must be further developed, was the Steffisbourg lathe for turning, grinding, etc., and also drilling polygon forms, the action of the tool carriage being controlled by former. A considerable number of lathes of the type associated with watch- and clock-making made by Buhlmann & Simonet and Schaublin-Villeneuve were shown, and Tornos automatics in which the job is taken to the tool, the latter being of plain form, may be noted, together with the Multipass automatic screw lathe by the Bechler firm. Very few machines were in operation. A commercial combination of a character with which English engineers are familiar is the Synergie concern, which, pooling experiences and avoiding competitive productions, unites Buhlmann & Simonet, of Soleure; Schaublin-Villeneuve, of Malleray; Usines Tornos, of Moutier; and J. Zehnder & Sons, of Gränichen, for the purpose of sales outside of Switzerland.

EMPLOYMENT CONDITIONS

In general conditions Switzerland is no exception to the rule, and the machine shops are for the most part working with reduced staffs on short time, though Alfred J. Amsler & Co., Schaffhouse, maker of many testing machines as well as planimeters, is on full time. At Oerlikon, on the machine-tool side, while the lathe factory is certainly running, any real activity is due to special machines. At Basle the business of Jaecklin Bros. has of course been acquired by the Burckhardt concern, who continue this department in its own separate works under the personal direction of R. and E. Jaecklin. The Burckhardt business is chiefly concerned with vacuum pumps and air compressors for extremely high pressures, while the Jaecklin machines are mainly for cutting, bending and working sheet metals. A stand at the exhibition combined the products of the two sides of the business.

Woodworking machinery was moderately represented at the fair, and it may be noted that the firm of Rauchenbach has been acquired by Fischer, of Schaffhouse. The Essaime firm, which exhibited a small press, has withdrawn from the Synergie combination and is closing at Tavannes in order to open a factory in France. The Tornos firm is also opening a French factory. The Pétermann firm in Moutier is moderately well engaged, also on automatics of the type in which the work moves to the tool, but the Société Genevoise d'Instruments de Physique finds no particularly urgent call and this is true also of the firm of J. Lambercier & Co., Geneva.

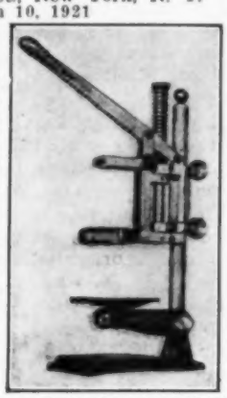
Southern Metal Trades Oppose Tariff Rates

William E. Dunn, Jr., secretary of the Southern Metal Trades Association, with headquarters in Atlanta, Ga., announces the adopting of resolutions at the recent meeting of the Western division of the association at Shreveport, La., protesting against a two-cent per pound tariff on imported manganese ore, and expressing opposition to a standard rate of pay for skilled workers. The division went on record in favor of a graded rate of pay according to the ability, experience and productive capacity of the workers. It was also decided at the meeting that the association as a whole will hereafter hold its meeting biennially, and divisional meetings at various intervals during each year. The association comprises in its membership many of the leading foundries and machine shops of the Southern states.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Stand, Electric Drill, Bench, Lever-Feed
Arnold Electric Tool Co., 114 Liberty St., New York, N. Y.
"American Machinist," March 10, 1921

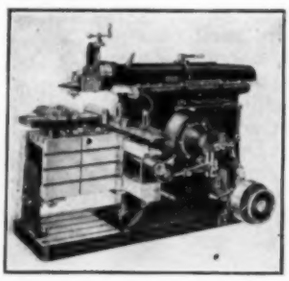


The device is intended to be used in connection with the company's portable drills, in order to make a lever-feed bench drill. A coil spring prevents the lever from dropping when the drill is not in contact with the work, or after the point of the drill has cut through. The head holding the drill can be shifted on the column, being clamped by means of thumbscrews. The table is 6½ in. in diameter, and can be pivoted in the table arm, which swings on the column. The distance from the center of the table to the column is 4½ in. The stand is furnished for two types of drills; the one for the Type B ½-in. drill weighing 40 lb. and the other for the Type C ¼-in. drill weighing 55 lb. It is 23 in. high and has a feed travel of 2½ in.

Hobbing Machine, Pinion, Large
J. E. Reinecker, A.G., Chemnitz, Germany
"American Machinist," March 10, 1921

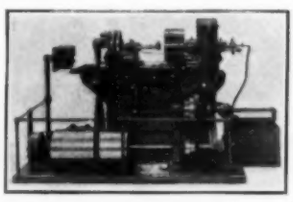
The machine is intended for hobbing the large pinions used in the reduction gearing of turbine-propelled ships. The toolslide swivels on the saddle, so that the hob may be adjusted to any desired angle. There is a continuous traverse of the hob so that the full cutting width is in service and wear is practically uniform. The motor is located at the rear of the bed. The driving gears are inclosed and run in an oil bath. The axis of the pinion being cut is placed horizontally, while it is vertical in the large gear-cutting machines made by the same concern.

Shaper, Heavy-Duty, High-Speed
Bertschy Engineering Co., Cedar Rapids, Iowa
"American Machinist," March 17, 1921



The shaper is built either with a cone-pulley drive or a single-pulley, gear-box drive. The standard sizes include 12, 16, 20, 24 and 32 in. shapers. The base of the machine has been extended beyond the sides of the table and around the column, in order to obtain ample foundation surface. The table can be supported at its outer end by braces on the end of the base. The power cross-feed is fitted with a friction safety device, to prevent damage due to feeding beyond the limits. On the cone-pulley driven machine, the pulley runs on a sleeve mounted on the column, thus eliminating the need of an outer bearing and taking the belt strain. The gear box on the single-pulley-driven shaper provides four changes of speed, thus, together with the two ratios in the bull-gear train, giving a total of eight speeds. The machine can be provided with a motor.

Grinding Machine, Internal, Motor Drive Attachment
Heald Machine Co., Worcester, Mass.
"American Machinist," March 17, 1921

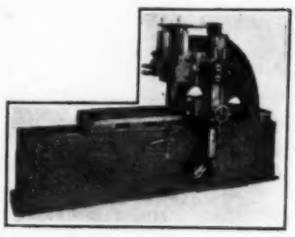


The motor drive attachment is adapted to the Nos. 70 and 75 internal grinding machines. The illustration shows a rear view of a machine equipped with the drive, the motor being at the front and left. The so-called "bass fiddle" casting is not employed. Instead of using the solid idler for the wheelhead, a flexible idler gives the proper tension to the wheelhead belt, as well as to the vertical belt between the drum and the idler. A swinging arm swivels on a bracket holding the driving cones, for varying the speed to the workhead. The swinging arm is connected to the workhead by a rod so fastened that it will allow the swiveling of the head either way and still keep the belt tight. Attaching the arrangement is said to be very simple, requiring only the removal of the standard guard over the workhead pulley, and the putting in its place a box containing the idler pulleys.

Hobbing Machine, Gear, 19½ Ft.
J. E. Reinecker, A.G., Chemnitz, Germany
"American Machinist," March 10, 1921

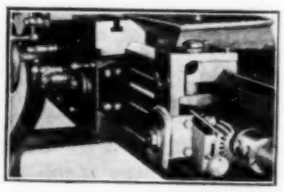
The machine is intended for hobbing the large gears used on turbine-propelled ships to obtain the speed reduction. Gears up to 19½ ft. in diameter and 6½ ft. in width, and weighing as much as 95 tons can be cut. The machine is not fitted for handling pinions, however. The revolving table is mounted on a spindle that rests on a large thrust bearing and is further supported and guided by a beveled ring of large diameter. A relieving device is located beneath the table support, so that the height of the table can be adjusted for varying loads by taking up the end thrust. The table spindle is hollow, so that work mounted on a shaft can be taken care of. The motor is located at the rear of the massive bed and is mounted on the box containing the driving gears.

Planer, Toolroom
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," March 17, 1921



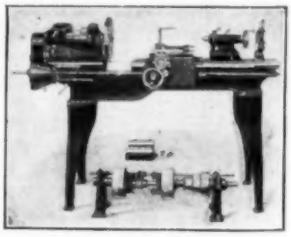
The planer has a bed of deep box section, extending to the floor, the top being cast closed except at the point where the bull gear engages the rack. The table is of box form, the bottom being closed and chips being removed through cored openings on the sides. Driving gears of the Maurform are used, the gearing being enclosed and running in oil. The table dogs can be quickly adjusted to position, a micrometer screw being provided on the front one for fine adjustment. The cross rail is clamped in position by means of a single lever mounted on the end of the rail. The machine is ordinarily belt driven, but can be driven by an adjustable-speed reversing motor connected directly to the drive shaft. The machine is made to take work up to 26 in. wide and 20 in. high, and in two stroke lengths, 6 and 8 ft.

Variator, Thread, Lead-Screw, Lathe
Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa.
"American Machinist," March 17, 1921



The device is intended for elongating or diminishing the normal lead on lathes, and also for correcting errors in the lead of the screw. It facilitates the use of an ordinary lathe for precision thread cutting. Metric threads can be cut without the use of translating gears. The variator is built in two sizes, Model A being adjustable to fit lathes having swings up to 12 in., and Model B to fit lathes of from 13 to 20 in. swing. The normal length of travel for the carriage is 6 in., but greater lengths can be provided. The variation in the lead is obtained by the rotation of a gear, in proportion to the angle at which the inclinable rack is set, as the nut is traversed by the action of the lead screw. In order to aid in setting the lead variator for either the normal lead of the screw or for a change of lead, a gage block is provided.

Lathe, Gap-Bed, "New Shepard"
Shepard Lathe Co., Rising Sun, Ind.
"American Machinist," March 17, 1921



The "New Shepard" 12-in. lathe is now made in a gap-bed style, in addition to the other models previously described in the American Machinist on page 917, Vol. 47, and on pages 90 and 136, Vol. 49. The swing is thus increased to 19 in. for a length of 5 in. in front of the faceplate. The section of the bed is reinforced at the the gap, and is said to be stronger there than at any other point of the bed. The carriage can over-run the gap without any lowering.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The machinery of the new pressed steel car plant at the works of the Chickasaw Shipbuilding and Car Co. at Fairfield, Ala., is being placed and announcement is made by officials of the corporation that the new plant will probably start operations this month. The production will average twenty-five cars per day, the plant starting off with orders for nearly 1,000 cars, some of which are for the United States Steel Corporation and 600 for the Louisville & Nashville R.R. The works have been under construction for more than a year.

The Ross Heater and Manufacturing Co., Inc., Buffalo, N. Y., has announced the opening of a branch office for the New York district at 2 Rector St. The sales agency office has been discontinued. C. M. Hardin is in charge of the new office.

The Charleston Bolt and Forging Co. has been organized at Nitro, W. Va., and will be incorporated with a capital stock of $250,000. The company will manufacture rivets, spikes and bolts of all kinds, drop forgings and other iron products. The officers are C. M. Dunnarant, president; H. A. Warren, vice-president; W. S. Stork, secretary and general manager; A. Bennett, treasurer.

Notice has been received of the removal of the Soc. Anon Belge Alfred Herbert, Brussels, to 34 Rue Melsens. This building was formerly occupied by the Allied Machinery Co., an American firm.

The Risdon Manufacturing Co., Naugatuck, Conn., recently increased its capital stock to $800,000. The company manufactures tools, etc.

The Plainville Casting Co., Plainville, Conn., has been organized by H. S. Washburn of Torrington, Conn., and William Stewart and Charles F. Conlon of Plainville, Conn. The company will manufacture castings and metal products. The business has been incorporated with a capital stock of $50,000 and the owners plan the erection of a plant in the near future on a site soon to be selected in Plainville.

The Air Service Division of the War Department has awarded the order for 145 portable electric drills to the James Clark, Jr., Electric Co., of Louisville, Ky.

The Rees Manufacturing Co. is the name recently assumed by the Iron City Products Co., Pittsburgh, Pa. The reason for the change was to enable the clients of the company, which makes Rees jacks to properly identify the company with the product.

The Lapointe Manufacturing Co. of Hartford, Conn., has been incorporated under the laws of the State of Connecticut, to manufacture wrenches, tools, etc. The capital stock of the company is $150,000 and the officials are: President, D. H. Lapointe; secretary, J. H. O'Brien, treasurer, V. H. Dauphinais. The business address of the company is 75 Prospect St., Hartford.

The Fenton Foundry Supply Co. has been incorporated at Dayton, Ohio, with $15,000 capital stock. Directors are William Fenton, E. P. Fenton, and others.

The Bickford-Switzer Co., Inc., of Greenfield, Mass., has recently been incorporated to engage in the manufacture of machinery, small tools and implements, etc. The incorporators are Frank O. Wells, Greenfield, Mass., who was formerly president of the Greenfield Tap and Die Corporation; Bernard M. Switzer, and O. S. Bickford of Greenfield.

The Osborn Machinery Corporation, Clarksburg, W. Va., has just been organized under the state law of West Virginia. William F. Osborn of New York, Herbert Johnston, T. A. Stout, H. E. Crites and Francis A. Osborn of Clarksburg are the incorporators.

From Canton, Ohio, comes the report of a contemplated merger of the United Alloy Steel Corporation, the Berger Manufacturing Co., and the United Furnace Co. The combination will represent a $42,000,000 investment and will be known as the Berloy Company of Canton.

The Manley Manufacturing Co. of York, Pa., has purchased the entire stock of dies, jigs and fixtures, patterns and good will of the Ellis Smith Manufacturing Co. of Elmira, N. Y. No change in the manufacturing methods or the product will be made.

The G. E. Engineering Co., Inc., has removed its general offices to more spacious quarters at 449 West 42d St., New York City.

The Reliance Electric and Engineering Co., Cleveland, Ohio, announces the removal of its Chicago office to Room 2013. Edward F. J. Linberg is district manager in charge.

The George H. Gibson Co., consulting engineers, has moved from the Tribune Building to the Hide and Leather Building at 100 Gold St., New York City.

Wickes Bros., Saginaw, Mich, has opened a sales office at 501 Fifth Ave., New York City. E. Braun is in charge.

The Herberts Machinery and Supply Co., of Los Angeles, Cal., has leased a building adjoining its present establishment and will make alterations to suit the business. This additional floor space of 11,000 sq.ft. has been deemed necessary due to the rapid expansion of business.

The Clark-Turner Piston Co., of Los Angeles, Cal., has purchased fifty-eight heavy-duty Monarch lathes and ten Rockford lathes. The order was placed with the Herberts Machinery and Supply Co., of Los Angeles. The tools will be used in taking care of the increased demand for De Luxe pistons. It is said that this is the largest individual lathe order ever placed on the Pacific coast.

Personals

B. FORTUIN has been elected president of the Duke Steel Co., New York, N. Y., succeeding W. B. Dukeshire, who has retired from the business.

T. E. DROHAN, for twelve years a superintendent in the Schenectady works of the General Electric Co., has been appointed mechanical superintendent of the switchboard department of that company. He will supervise this work at the Schenectady, Philadelphia, and Baltimore works.

O. C. BERRY, formerly professor of automotive engineering at Purdue University and research engineer for the Hupp Motor Car Corporation, has joined the staff of the Wheeler-Schebler Carbureter Co., Indianapolis, Ind. He will be chief engineer.

D. C. PAUL, formerly of Gaul, Derr & Shearer, of Philadelphia, is now representing the Black & Decker Manufacturing Co., of Baltimore, Md., in charge of the Pittsburgh branch. Associated with Mr. Paul are Frank E. Marrion and J. A. Miller.

HAROLD P. CHILDS, general manager of the Charleston Industrial Corporation, Charleston, W. Va., has resigned to accept an important position in the executive offices of the General Electric Co. in New York City.

JOHN E. KING, production manager of the Nordyke & Marmon Co., Indianapolis, Ind., and well known to the machinery trade of the state because of his long experience in the business, was successful recently in the city primaries in his race for the Republican nomination as councilman from the sixth district. Mr. King has been committeeman of his precinct for seven years.

JOHN M. HILTY, foreman of the Altoona shop of the Peoples Natural Gas Co., of Pittsburgh, Pa., has been transferred to Woodlawn as foreman. He is succeeded in Altoona by James A. Sloan, of Portage.

E. D. JONES has been recently selected as manager of field sales for the Yale & Towne Manufacturing Co., of Stamford, Conn.

Forthcoming Meetings

The American Railway Association will hold the Spring meeting of its Purchases and Stores Section at the Blackstone Hotel, Chicago, June 9 to 11, and the Spring meeting of its Mechanical Section at the Drake Hotel, Chicago, June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

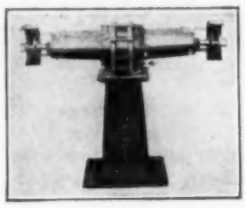
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Buffer, Electric, Heavy-Duty, Johnson

U. S. Electrical Manufacturing Co., Central Ave., at Third St., Los Angeles, Cal.

"American Machinist," March 17, 1921



The machine has an overall shaft length of approximately 5 ft., so that two men can work at the same time without interfering with each other. It was developed for use on pneumatic truck tires, but is adaptable to heavy-duty buffing of all sorts. The spindle is supported by a double set of ball bearings. One set of the bearings is placed at each end of the machine next to the wheels, with the other set at the center, to prevent periodic vibration of the rotor. A heavy pedestal supports the motor, guards being provided for the wheels, which can be up to 12x2 in. in size. The buffer is entirely inclosed, and can be furnished in various sizes for use in two or three-phase alternating current.

Brush, Wire, Rotary, Thor

Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.

"American Machinist," March 17, 1921

The brush is intended for use on either the No. 71 portable pneumatic grinder or the No. 6 electric grinder made by the concern. The brush shown in the illustration attached to the No. 71 pneumatic grinder is 5 in. in diameter; but the brush intended for use on the No. 6 electric grinder is only 4 in. in diameter, because of the fact that the electric grinder runs at a higher rate of speed than the pneumatic tools. The device is intended particularly for the removal of paint, rust or scale, being adapted to such work as the cleaning of steel cars, automobile bodies and castings. The wires of the brush are 3 in. in length, being made of heat-treated steel and tapered at the end attached to the brush, so as to give greater strength at that point. They are held in a concave wooden back, which is fitted in a metal cover.

Toolholder, "Holds-Em All"

Simmons Economy Tool Corporation, Albany, N. Y.

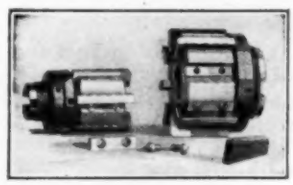
"American Machinist," March 17, 1921

The toolbit rests in a right-angle groove, and is held in place by means of a clamping plate placed at an angle. The plate bears at its upper edge on the end of the shank, and is secured by means of a setscrew having a spherical bearing. A second small screw is provided, so as to furnish a third point of support for the clamping plate in case that the toolbit is very short. Toolbits or stock of any section can be securely held, it is stated. The holder is drop-forged. The tool is made in either straight, right-hand or left-hand style, and in eleven different sizes. The smallest holds bits from $\frac{1}{16}$ to $\frac{5}{16}$ in. in size, and its dimensions are $\frac{5}{8}$ by $\frac{3}{4}$ by $4\frac{1}{4}$ in. The largest holder is for bits from $\frac{1}{2}$ to $\frac{3}{4}$ in., and is itself $1\frac{1}{4}$ by 3 by 20 in. in size.

Reamer, Shell, Adjustable, Inserted-Tooth

Cleveland Cutter and Reamer Co., 1619 Merwin Ave., Cleveland, Ohio

"American Machinist," March 17, 1921

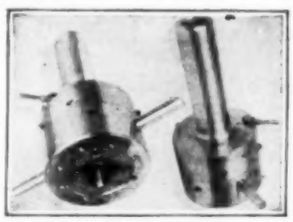


The backs of the blades are provided with corrugations placed at an angle and fitting corresponding grooves in the slots in the body. The reamer has a double adjustment. By screwing back the locknuts in the rear of the blades $\frac{1}{8}$ in. a diameter adjustment of 0.083 in. can be obtained. Placing the blades up one step in the corrugations adds another 0.083 in. to the diameter of the reamers, so that the locknuts can be moved forward. This action can be continued until the blades are worn out, when they can be replaced. The reamers are regularly made with the blades set straight in the body as shown; but reamers with helical blades can be furnished. The standard sizes range from 1 to 6 in. in diameter. The overall length varies from $2\frac{1}{4}$ to $3\frac{1}{4}$ in. and the diameter of the hole in the large end from $\frac{3}{8}$ to 2 in.

Die-Head, Self-Opening, Style-H

Modern Tool Co., Erie, Pa.

"American Machinist," March 17, 1921

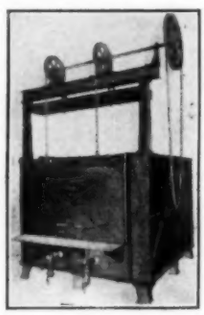


This tool has supplanted the Style-B head in all sizes from Nos. 1 to 6 inclusive. The head is intended for general threading work, and can be used on the turrets of hand or automatic screw machines. It can be fitted with a closing device, so that it may be used on a drill press or other revolving-spindle machine. The chasers are supported at their outer edge by a cam ring which, it is claimed, makes it impossible for the chasers to change position while working. The die heads are made of hammered tool steel. The chasers are made by the hobbing method and are interchangeable only by sets. A floating device is incorporated between the body and shank of the die-head to compensate for inaccurate adjustment of the turret. The small lever at the shank end is used for changing from the roughing to the finishing size, and vice versa.

Furnace, Annealing

Bellevue Industrial Furnace Co., Detroit, Mich.

"American Machinist," March 17, 1921

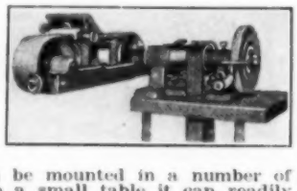


The furnace is of the semi-muffle type and can be heated by either oil or gas. It is equipped with a hand-operated chain mechanism for raising or lowering the door, the weight of the door being suitably counter-balanced. Two of the company's standard oil-burners are ordinarily used for heating the furnace and are located at the front, where they are easily available for adjustment. The gas burners can be substituted if desired. The furnace is built in six sizes, the muffles being from 56 to 78 in. wide, 60 to 120 in. deep, and 8 to 24 in. high, the dimensions of the minimum and maximum sizes being given.

Surfacing Machine, "Junior"

Peerless Surfacing Machine Co., Inc., Troy, N. Y.

"American Machinist," March 17, 1921

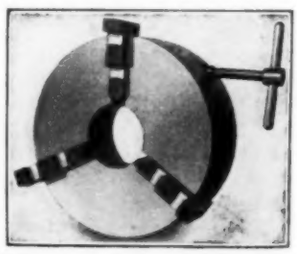


The machine is small and compact and intended for the surfacing of small work. An arm, swinging around the drive shaft, carries two pulleys, on which the abrasive belt runs. The arm can be clamped in any position, as can the small rest for holding the work on the belt, thus making it possible to grind the work at any angle desired. The machine is of the bench style, so that it can be mounted in a number of different ways. When attached to a small table it can readily be moved around the shop from one job to another. It can be driven from a countershaft or by a separate motor, either belted to it or connected directly to the end of the shaft. Tight and loose pulleys with a belt shifter are provided. A grinding wheel or disk plate up to 11 in. in diameter can be carried on the shaft. A work rest is provided.

Chuck, Self-Centering

H. Spillman, Zurich, Switzerland

"American Machinist," March 17, 1921



The chuck is operated by worm gearing in connection with a scroll plate which differs from the usual construction of such members, inasmuch as the scroll proper is not an integral part of the plate. The scroll has slightly more than one convolution, so that but one tool in any chuck-jaw is engaged at one time except when it is in position where the ends of the scroll overlap. This construction makes it possible to have all the teeth in the jaws of such shape as will insure a good bearing on the scroll. In addition, the scroll is very heavy, is let into a groove in the plate and is hardened and ground. The jaws are made of steel and are hardened and ground.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED SHOPS

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. Y., New York (Borough of Brooklyn)—E. B. Stimpson, 68 Franklin Ave., presses V. & O. make sizes 2½, 3, 4 and 5 for machine shop.

N. Y., New York (Borough of Manhattan)—The Halpern Wein Co., 110 West 40th St., would like catalogues and prices on machine tools for railroad shop and locomotive works in Sweden.

N. Y., Syracuse—The Mellrun Gabrielson Corp., Industrial Bldg., manufacturer of milling machines, A. Mellrun, Purch. Agt.—general machine shop tools and machines, machinery, etc.

Ill., Chicago — The Precision Metal Workers, 3100 Carroll Ave.—equipment for making 5⅞ in., 6 in. and 6¾ in. metal discs, of 22 gauge metal.

Ill., East St. Louis—C. O. McCasland, 6225 Easton St.—drill press and lathes, for garage to be erected on 11th and State Sts.

Mich., Benton Harbor—The Benton Harbor Forging Co.—die sinking machine for drop forgings.

Mich., St. Joseph—The St. Joseph Iron Wks., 606 Water St.—1 vertical boring mill, milling machines, lathes, 1 keyseater, drill presses and grinding wheels for proposed addition.

Que., Montreal—W. Mahoney, 162 Anger St.—2 lathes and other machine shop equipment.

Que., Montreal—M. Roberts, 570 Dorchester St., East.—lathe and other garage repair equipment.

Ont., London—The London Motors Ltd., W. Stansell, Pres.—machinery for the manufacture of autos.

Machinery Wanted

O., Columbus — The North Columbus Lumber Co., Penn R.R. and Mack Rd., L. Koons, Genl. Mgr.—entire planing mill equipment including sander, sticker, planing mill, frame machines, moulding machines, etc.

Wis., Milwaukee—The Amer. Metal Products Co., 671 Kinnicinnic Ave.—foundry equipment.

Wis., Milwaukee—The South Side Wet Wash Laundry, 641 15th Ave.—laundry equipment.

Mo., Joplin—The Duplex Tire & Rubber Co., 71 New Jates Hotel—machinery.

Que., Montreal—The Fire Proof Crushed Stone Co., Inc., 2650 Masson St.—crushing plant machinery.

Que., Montreal — The North West Side Oil Co. Ltd—Keystone drills and other well drilling equipment. W. H. Butler, Pres. of the Canadian Car & Fdry Co. Ltd., Dir.

Que., Montreal — H. Peladeau Ltd., 1211 Ontario St., East.—complete planing mill equipment.

Ont., Carleton Place—C. F. Burgess—flour and feed grinding machinery.

Ont., Ottawa—The Retail Grocer's Association—bakery machinery.

Metal Working

NEW ENGLAND STATES

Conn., East Hartford—(Hartford P. O.) Popp & Wespiser, Springfield, Mass., will soon award the contract for the construction of a 1 story garage and service station on Main St. and Burnside Ave. Estimated cost, between $30,000 and $40,000. Private plans.

Conn., Hartford—J. D. Bossen, 771 Asylum St., has awarded the contract for the construction of a 1 story, 60 x 60 ft. garage.

Conn., Hartford—J. B. Kauffman, 432 Windsor Ave., is having plans prepared for the construction of a 1 story, 50 x 110 ft. garage. Estimated cost, $25,000. B. A. Sellew, 721 Main St., Archt.

Conn., Hartford — W. H. Roberts, 22 Chapel St., will build a 1 story, 35 x 100 ft. garage. Estimated cost, $10,000.

Conn., Norwalk — A. I. Crandall has awarded the contract for the construction of a 1 story, 97 x 150 ft. garage and service station on West Ave. Estimated cost, $60,000.

Conn., Waterbury — I. N. Albert, 268 South Main St., will soon award the contract for the construction of a 1 story, 50 x 185 ft. garage on North Main St. Estimated cost, $40,000. F. A. Wenzel, 6 Glen Ridge St., Archt. Noted May 19.

N. H., Maplewood—The Maplewood Hotel Co., Bethlehem, has awarded the contract for the construction of a 1 story, 30 x 60 ft. garage. Estimated cost, $10,000.

Mass., Boston—The Y. D. Service Garage, c/o Funk & Wilcox Co., Archts., 294 Washington St., is having plans prepared for the construction of a 6 story garage on Newbury St. Estimated cost, $600,000.

Mass., Dorchester—Bichekas & Maharas, 1226 Massachusetts Ave., will soon award the contract for the construction of a 1 story, 40 x 66 ft. garage. Estimated cost, $10,000. Stebbins & Watkins, 164 Federal St., Boston, Archt.

Mass., Gloucester—Perkins & Corliss Co., Middle St., has awarded the contract for the construction of a 2 story, 60 x 150 ft. garage on Western Ave. Estimated cost, $50,000.

Mass., Lowell—Katz Bros., 202 French St., will build a 1 story, 97 x 99 ft. garage on Brooking St. Estimated cost, $25,000.

Mass., Springfield—E. T. Davis, 67 Bliss St., will build a 1 story garage on Bliss St. Estimated cost, $22,000.

Mass., Springfield — A. Freedman, 27 Church St., will build a 1 story machine shop on 7th St. Estimated cost, $15,000.

Mass., Springfield—J. G. Riga & Sons Co., 699 Main St., has awarded the contract for the construction of a 2 story, 40 x 58 ft. auto sales and garage building on Dwight St. Estimated cost, $40,000.

Mass., Worcester—The G. E. Duffy Mfg. Co., 1511 Main St., has awarded the contract for the construction of a 1 story garage to cover 6,000 sq.ft. of floor space. Estimated cost, $25,000.

R. I., Providence—Kelman & Lagovitz, 32 Ash St., will build a 1 story garage and service station on Willard Ave. and Hilton St. Estimated cost, $10,000. Noted May 19.

R. I., Providence — The Narragansett Electric Lighting Co., Turks Head Bldg., will soon award the contract for the construction of a 2 story, 114 x 172 ft. garage and boiler house on Melrose St. Estimated cost, $200,000. Jenks & Ballou, 735 Grosvenor Bldg., Archts. and Engrs.

MIDDLE ATLANTIC STATES

N. J., Bordentown—C. Soden, 3d St., plans to build a garage on Park St. Architect not selected.

N. Y., New York—(Borough of Manhattan) The Knickerbocker Ice Co., 1480 Bway, has had plans prepared for the construction of a 1 story, 120 x 130 ft. garage on West 167th St. Estimated cost, $25,000. DeRosa & Cavalieri, 370 East 149th St., Archts. and Engrs.

N. Y., New York—(Borough of Manhattan) The Moranis Realty Corp., c/o J. S. Maher, Archt. and Engr., 431 West 14th St., is having plans prepared for altering a 4 story garage at 108 West 50th St. Estimated cost, $50,000.

N. Y., Syracuse — The Mellrun Gabrielson Corp., Industrial Bldg., manufacturer of milling machines plans to build a 2 story, 70 x 150 ft. factory on West Lafayette St. Estimated cost, $300,000. Architect not yet selected.

SOUTHERN STATES

La., New Orleans—The F. H. Koretke Brass & Mfg. Co. Ltd., 922-26 Magazine St., plans to build additions to its brass foundry. W. E. Gosselin, Vice-Pres. and Mgr.

MIDDLE WEST STATES

Ill., Chicago—The Atlas Copper & Brass Mfg. Co., 2734 High St., plans to construct a 1 story, 50 x 125 ft. addition to its factory at 2736 High St. Estimated cost, $20,000. L. Ehle, 3810 Bway, Archt. and Engr.

Ill., Chicago—I. Engel, 3058 Armitage Ave., will soon award the contract for the construction of a 1 story, 60 x 150 ft. garage at 3515 Armitage Ave. Estimated cost, $40,000. H. I. Dalsey, 2321 West North Ave., Archt.

Ill., Chicago—T. J. Keriman, 5859 South Prairie Ave., will soon award the contract for the construction of a 1 story, 75 x 160 ft garage at 5825 Prairie Ave. Estimated cost, $35,000. J. J. Kocher, 6250 South Halsted St., Archt.

THE WEEKLY PRICE GUIDE

This Week's Market

Business in the steel trade is extremely light. Warehouses report that deliveries from mills are poor, owing to reduced production. Orders are so small that mills accumulate them until there are enough to warrant changing rolls.

The metal market is a little stronger than earlier in the week, especially with regard to copper, which is now 14⅜c. per lb. Domestic buying is light, but foreign orders have already raised the price of copper. Copper and brass products are up ⅛c. in New York.

The market for shop supplies is very weak, and prices in New York are useful only as a guide.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.50
Northern Basic	25.32
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.50
Basic	21.75
Bessemer	24.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.80	5.20
Nos. 22 and 24	3.85	4.85	4.85	5.25
No. 25 and 26	3.90	4.90	4.90	5.30
No. 28	4.00	5.00	5.00	5.40
Galvanized				
No. 10 and 11	4.00	4.75	5.00	5.70
No. 12 to 14	4.10	4.85	5.10	5.80
Nos. 17 and 21	4.40	5.15	5.40	6.10
Nos. 22 and 24	4.55	5.30	5.55	6.25
No. 26	4.70	5.45	5.70	6.30
No. 28	5.00	5.75	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	50%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods(base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	⅜	33½	18½
			1 to 1½	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1½	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	14.37½
Tin in 5-ton lots	33.00
Lead	5.50
Zinc	5.75
ST. LOUIS	
Lead	5.10
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.75	22.00	23.50
Copper wire (carload lots)	15.75	17.50	20.00
Brass sheets	17.00	21.00	20.75
Brass pipe	20.75	24.00	24.50
Solder (half and half) (case lots)	24.00	22.75	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.00
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	12.15	12.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.50
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	8.00	7.65
Lead, heavy	3.25	4.00	3.00
Lead, tea	2.00	3.00	2.85
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	4.50
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75-10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50-10%	60-10%	50%
1¼ and 1½ in. by 3 in. up to 12 in.	50%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¾ by 6 in. and smaller	40%	50-10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.79
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.89

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ½-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.75	$0.82
5-gal. cans	.83*	.85	1.07

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Ill., Chicago—B. T. Olsen, c/o C. Hatzfeld, Archt., 7 South Dearborn St., is having plans prepared for the construction of a 1 story, 85 x 180 ft. garage on Catalpa Ave. and Bway. Estimated cost, $30,000.

Ill., Chicago—W. F. Pagels, Archt., 1412 Berteau Ave., will soon award the contract for the construction of a 1 story, 100 x 125 ft. garage at 4535 North Kedzie Ave., for T. H. Kibling, 4523 North Kedzie Ave. Estimated cost, $35,000.

Ill., East St. Louis—C. O. McCasland, has awarded the contract for the construction of a 1 story, 65 x 93 ft. garage and repair shop on 11th and State Sts. Estimated cost, $50,000.

Ill., Rockford — The Petroleum Motors Corp., c/o R. C. Dale, 220 South State St., Chicago, has awarded the contract for the construction of a 1 and 2 story, factory to consist of 3 units to be 270 x 720, 75 x 220 and 50 x 100 ft. Estimated cost, $2,000,000. Noted May 5.

O., Cleveland—The Ohio Ice Machine Co., Columbus Rd., has awarded the contract for the construction of a 1 and 2 story, 60 x 110 ft. machine shop on Madison Ave. and West 58th St. Estimated cost, $40,000.

O., Cleveland—P. Tolaro, 2645 East 110th St., has had plans prepared for the construction of a 1 story, 40 x 110 ft. garage on Woodland Ave. and East 110th St. Estimated cost, $40,000. F. A. Azzorello, 2403 East 9th St., Archt.

O., Cleveland Heights—(Warrensville P. O.) The Heights Battery Co., 2777 Mayfield Rd., is having plans prepared for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost, $40,000. R. H. Hinsdale, Bangor Bldg., Cleveland, Archt.

O., Columbus — The Columbus Forge & Iron Co., Ft. of West First Ave., will receive bids about June 20 for the construction of a 1 story, 70 x 200 ft. and a 1 story, 110 x 123 ft. factory buildings. Estimated cost, $80,000. Brown, Fleming, Knollman & Prior, 233 South High St., Archts.

Mich., Detroit—The Street Ry. Comn., 320 Murphy Bldg., plans to build a 1 story, 250 x 350 ft. car repair shop on St. Jean, Lillebridge and Warren Aves. W. C. Markham, 20 Murphy Bldg., Engr.

Wis., Milwaukee—The Amer. Metal Products Co., 671 Kinnicinnic Ave., has awarded the contract for the construction of a 1 story, 80 x 200 ft. foundry and machine shop on Burnham St. Estimated cost, $65,000.

Wis., Milwaukee—Imanski & Gehrmann, 1078 23d Ave., have awarded the contract for the construction of a 1 story, 46 x 112 ft. garage. Estimated cost, $42,000.

Wis., Milwaukee—The Magnetic Mfg. Co., 764 Windlake Ave., has awarded the contract for the construction of a 1 story, 92 x 120 ft. machine shop on South Pierce St. and 23d Ave. Estimated cost, $40,000.

STATES WEST OF THE MISSISSIPPI

Mo., St. Louis—Nolte & Nauman, Archts., Fullerton Bldg., will soon award the contract for the construction of a 1 story, 100 x 270 ft. garage and machine shop on Hodiamont Alley East and Taylor St., for the Davie Motor Car Co., 1900 Washington St. Estimated cost, $40,000. A. F. Davie, Pres. Noted May 5

Mo., Trenton—The Chicago, Rock Island & Pennsylvania R.R., 137 Van Buren St., Chicago, Ill., plans to build a 1 story, 87 x 100 ft., car repair shop. Estimated cost, $60,000. A. T. Hawk, Archt.

CANADA

Ont., London—The London Motors Ltd. plans to build a 1 story auto factory on Hale St. Estimated cost, $75,000. W. Stansell, Pres.

Ont., London—Warren Bros., 314 Talbot St., plans to build a 1 story machine shop. Estimated cost, $25,000. M. Warren, Mgr.

General Manufacturing

NEW ENGLAND STATES

Conn., Danbury—C. Rider, 11 New St., has awarded the contract for the construction of a 2 story, 36 x 90 ft. addition to his creamery building. Estimated cost, $20,000.

Conn., New Britain—E. R. Hitchcock & Co., 303 Main St., is having plans revised for the construction of a 3 story, 45 x 95 ft. printing and bindery plant on Chestnut St. Estimated cost between $40,000 and $50,000. D. K. Perry, 27 West Main St., Archt. Noted March 17.

Conn., Norwalk—Fletcher-Thompson, Inc., Archts. and Engrs., 542 Fairfield Ave., Bridgeport, will soon award the contract for the construction of a 1 story, 90 x 200 ft. factory for the manufacture of windshields and other glass products on Main St., for C. H. Harris, Inc., 136 West 24th St., New York City. Noted May 26.

Mass., Fitchburg—The Parkhill Mfg. Co., River St., will soon award the contract for the construction of a 2 story, 35 x 80 ft. addition to its factory for the manufacture of gingham goods. Estimated cost, $25,000. Private plans.

Mass., Malden — The Malden Knitting Mills, 62 Franklin St., will build a 4 story, 45 x 140 ft. addition to its factory. Estimated cost, $60,000.

Mass., Natick—C. W. Dean & Co., North Main St., has awarded the contract for the construction of a 3 story, 42 x 170 ft. addition to its shoe manufacturing plant, etc. Estimated cost, $100,000. Noted March 10.

Mass., North Andover—M. T. Stevens & Sons Co., has awarded the contract for the construction of a 5 story, 60 x 155 ft. addition to its woolen mill. Estimated cost, $150,000.

Mass., Somerville—The Winchester Mfg. Co., 611 Cambridge St., Cambridge, is having plans prepared for the construction of a 2 story, 55 x 125 ft. factory for the manufacture of novelties on Beacon St., here. Estimated cost between $40,000 and $50,000. Tuck & Gilman, 34 School St., Boston, Archts. and Engrs.

R. I., Pawtucket—A. Poirier, Bway and North Main Sts., has awarded the contract for the construction of a 1 story, 92 x 40 ft. laundry on Bway. Estimated cost, $15,000.

MIDDLE ATLANTIC STATES

N. J., Penns Grove—The General Preserving Co., Chester, Pa., plans to build a canning factory. Architect not selected.

N. Y., New York (Borough of Brooklyn)—The Cheek & Neal Coffee Co., Cummins Station, Nashville, Tenn., has awarded the contract for the construction of a 5 story factory on 40th St. and 2d Ave. Estimated cost, $175,000.

Pa., Altoona—The Schwarzenbach Huber Co., 8th Ave. and 24th St., plans to build a 2 story, about 100 x 200 ft. silk mill at East End. Estimated cost, $75,000. R. Brupbacher, Supt.

Pa., Johnstown—The Johnstown Ledger Publishing Co., 221 Franklin St., plans to build a 1 story, 60 x 120 ft. newspaper plant on Main and Walnut Sts., to replace the one recently destroyed by fire. Estimated cost, $75,000. H. Hesselbein, Owner.

Pa., Pittsburgh—The North Pole Ice Co., 1218 West Carson St., will receive bids until June 9 for the construction of an ice storage plant on Carson St. W. Griesser, 224 Meyron Ave., Archt.

Pa., Scranton—The Scranton Dress Co., c/o Lockwood Greene & Co., Archts. and Engrs., 101 Park Ave., New York City, has awarded the contract for the construction of a 1 story factory at 100 South Webster Ave. Estimated cost, $350,000.

SOUTHERN STATES

N. C., Salisbury—The Paul Rubber Co. has awarded the contract for the construction of a 2 story, 60 x 100 ft. auto tire factory. Estimated cost, $30,000.

MIDDLE WEST STATES

Ill., Chicago—Ludgin & Levinton, Archts., 53 West Jackson St., will soon award the contract for the construction of a 3 story, 35 x 45 ft. addition to the glove factory at 1915 Milwaukee Ave., for the J. A. Dukow Glove Co., 1911 Milwaukee Ave. Estimated cost, $35,000.

O., Cleveland—The Knoble Refining Co., c/o L. A. Ritzman, 607 Canal Rd., will soon award the contract for the construction of a 1 story factory and boiler house on East 99th St. and Elk Ave. Estimated cost, $80,000. L. C. Scott, c/o Owner, Archt.

O., Columbus—The Lilles Laundry, 1011 West Rich St., has awarded the contract for the construction of a 1 story, 44 x 88 ft. addition to its laundry. Estimated cost, $5,000.

Wis., Black Creek—The Ontagamie Limestone Co., 75 30th St., Milwaukee, is having preliminary plans prepared for the construction of a quarry plant. Estimated cost, $200,000. H. O. Weldon, 10 South La Salle St., Chicago, Ill., Engr.

Wis., Marshfield—Blum Bros., West 9th St., have awarded the contract for the constructon of a 2 story, 62 x 178 ft. cheese box factory on Main St. Estimated cost between $25,000 and $30,000.

Wis., Milwaukee—The South Side Wet Wash Laundry, 641 15th Ave., has awarded the contract for the construction of a 2 story, 32 x 60 ft. addition to its laundry. Estimated cost, $40,000. Noted Jan. 20.

Wis., Neenah—G. Danke, Main St., is having plans prepared for the construction of a 2 story, 40 x 80 ft. creamery on South Commercial St. Estimated cost, $40,000. Auler & Jensen, F. R. A. Bldg., Oshkosh, Archts.

Wis., Sheboygan Falls—The Falls Roller Mills, c/o E. Gonzerbach, Mgr., will build a 5 story, 80 x 140 ft. flour mill on Main St. Estimated cost, $75,000. Noted April 7.

STATES WEST OF THE MISSISSIPPI

Ia., Cedar Rapids—The Peterson Baking Co., 316 6th Ave. East, has awarded the contract for the construction of a 2 story, 60 x 140 ft. factory on 3d St. East and 6th Ave. Estimated cost, $46,035. Noted May 12.

Mo., Joplin—The Duplex Tire & Rubber Co., 71 New Jates Hotel, is having preliminary plans prepared for the construction of a 3 story, 100 x 300 ft. tire factory on 7th St. Estimated cost, $100,000.

Mo., Springfield—The Welsh Packing Co. will soon award the contract for the construction of a 3 story, 120 x 160 ft. packing plant. Estimated cost, $100,000. M. P. Burt & Co., Falls Bldg., Memphis, Tenn., Archt. Noted April 21.

Neb., Omaha—The Baker Ice Machine Co., 19th and Nicholas Sts., has awarded the contract for the construction of a 1 story, 100 x 280 ft. factory. Estimated cost, $150,000.

CANADA

Ont., Exeter—The Ontario Flax Mill is preparing plans for the construction of a 1 story, 50 x 100 ft. flax mill. Estimated cost, $25,000.

Ont., Kingsville—Brown & Wigle plan to rebuild their woolen mill which was recently destroyed by fire. Estimated cost, $500,000. E. A. Brown, Mgr.

Ont., London—W. T. Rawleigh, 55-65 Liberty St., Freeport, Ill., plans to build a 6 story, 75 x 200 ft. factory for the manufacture of drugs and stock food, on Adelaide St. Estimated cost, $150,000. G. W. Corbett, Adelaide St., London, Mgr.

Ont., New Liskeard — Black, Fasken & Hennessey, c/o A. Fasken, Pres., Excelsior Life Bldg., Toronto, plan to build a ground wood pulp mill on Dixon Creek, here. Estimated cost, $500,000.

Ont., Ottawa—The Ottawa Grouse Associated, 333 Elgin St., plans to build a bakery on Breeze Hill Ave. Estimated cost, $50,000. Architect not selected. Address B. G. Crabtree.

Ont., Ottawa — The Retail Grocer's Association plans to build a bakery on Breeze Hill Ave. Estimated cost, $45,000. T. W. Collins, 317 Wilbrod St., Secy. Architect not selected.

Ont., Ottawa—The Slinn Bread Co., 453 Catharine St., has awarded the contract for the construction of a 2 story, 66 x 110 ft. bakery on Catherine St. Estimated cost, $80,000. Noted April 7.

Ont., Toronto—The Ideal Bread Co., Ltd., 183 Dover Court Rd., has purchased a site and plans to build a bakery. Estimated cost, $100,000. Architect not selected.

Alaska, Ketchikan—The Ketchikan Cold Storage Co. has awarded the contract for the construction of a 5 story cold storage and ice plant. Estimated cost, $100,000.